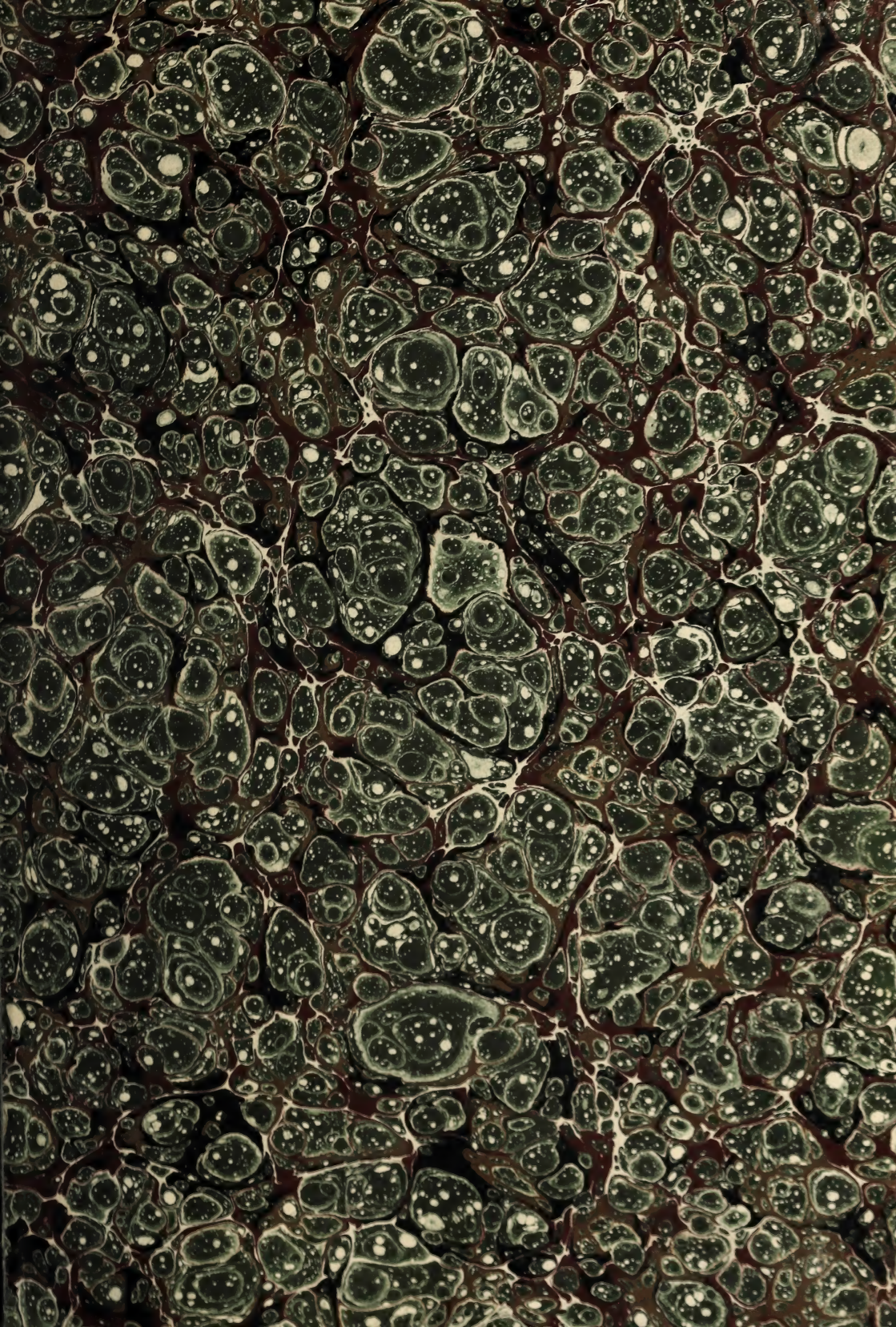


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HINTS
ON THE
PRESERVATION OF LIVING OBJECTS
AND THEIR
EXAMINATION UNDER THE MICROSCOPE.

BY
THOMAS BOLTON, F.R.M.S.,
17, ANN STREET, BIRMINGHAM.

[Reprinted from the "English Mechanic and World of Science."]

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HINTS ON THE PRESERVATION OF LIVING OBJECTS, AND THEIR EXAMINATION UNDER THE MICROSCOPE.

I have often been asked by my correspondents how best to examine the living objects I am sending them, and also how best to keep them alive for further examination, and to watch their continued growth, development, and reproduction; and I shall be glad (with the Editor's permission) to give all the information I can on these points to the best of my ability. The larger organisms, and such as are usually attached in their growth to weeds, I generally forward in glass tubes about half an inch in diameter, and two inches long; but unattached organisms, such as free-swimming rotifers, infusoria, volvoces, &c., I put in smaller tubes a third of an inch in diameter and 1½ in. long; the latter holds half a drachm of water, and the former three times as much. Of course, larger objects, such as young newts, embryo fish, &c., which I occasionally send out, require larger tubes or bottles, which entail much extra care in package to allow for the much greater danger of breakage and leakage.

When such tubes as I have described are received by post they should be opened, uncorked, and, if they cannot be examined at once in the microscope, it is well to take a bung cork with a hole bored in by a cork borer to fit the tube. Pass the tube into the hole so that the top is level with the top of the cork, and so float the tube and its contents on the surface of water in a tumbler, basin, or still better, in an aquarium. In this way much danger to the life of the more delicate animal organisms will be avoided from variations of temperature, which are not unlikely to occur in so small a body of water as the tubes themselves contain. In this way many of the advantages of a large body of water are obtained without any danger of the objects being lost, or diffused over too large a field to be readily found again.

EXAMINATION OF OBJECTS ATTACHED TO WEEDS AND ROOT FIBRES, SUCH AS POLYZOA, HYDRA, TUBE-DWELLING ROTIFERS, VORTICELLIDÆ, &c.

Examine the contents of the glass tube with a pocket lens of about two inch focus. The tube case of a *Melicerta ringens* would be readily seen like a little black thorn standing erect from the surface of the leaves of the anacharis, myriophyllum, or other weed, and often attains the length of a tenth of an inch. If the tube be examined in the front of a window and held a little sideways so that the direct light of the window does not enter the eye, a little higher power of lens, such as Browning's platyscopic lens, will reveal the beautiful red colour of the tube in fine contrast with the bluish hyaline ciliatory wreath, apparently whirled round its mouth in rapid gyrations. Many other organisms may be readily detected, and some of their beauties guessed at in this way, and a little practice will soon enable the student to recognise most of the larger and many of the more minute organisms, or, which is perhaps more important, see that there is something he does not recognise, and which will require the use of the compound microscope to bring out the details and reveal its nature.

If the objects are attached to such a weed as the anacharis, after noting under the pocket lens, as above, the position of the several specimens on

the weed, it will be best to transfer the weed by a pair of forceps from the tube to a zoophyte trough (about $2\frac{1}{2}$ in. long, $1\frac{1}{2}$ in. high, $\frac{3}{4}$ in. thick or deep), into which the water from the tube is poured, together with sufficient soft or tap water to nearly fill it. Examine again with pocket lens, and adjust the weed into a suitable position for the examination of some one or more of the specimens.

Place the trough, if convenient, at once in the microscope, and let it remain some hours at rest, and doubtless, if not before, it will now be seen to advantage.

In this position it may with advantage be examined with low powers, such as the 3 in., $1\frac{1}{2}$, and $\frac{3}{4}$, and possibly occasionally, when it is peculiarly well placed, with the 4-10ths objective.

In such a trough it may be expected to live a week or so without change of water, or it may be kept longer in a small saucer, or evaporating dish, or still better in a fresh-water aquarium, in which the individual would very likely propagate and increase.

The student should carefully examine the whole of the weed under the low powers in the trough, and it is very likely he will be repaid by seeing some younger individuals just commencing the building of their tube, and he may possibly find others in a still earlier state swimming or creeping amongst the leaves.

For examination of the *Melicerta* under the $\frac{3}{4}$, 4-10th, and $\frac{1}{4}$ in. powers, it may be advantageously placed in a slide trough or tube cell of about 1-6th of an inch or less, covered with thin glass. To do this an individual should be noted on the weed, conveniently placed on a leaf, or, still better, on the stem. With a small pair of sharp-pointed scissors, the leaf on which the individual is placed should be cut off the weed, leaving a small piece of the stem attached, and so transferred to the trough or cell. It may sometimes be necessary, with the scissors, to pare down or split the leaf carefully without injuring the specimens, so as to reduce the leaf to a less width than the depth of the trough or cell. This being done, the leaf can be placed in the trough or cell sideways, and the piece of stem attached to it retains it in that position, otherwise the *Melicerta* tube, which is generally built in a position standing up from the surface of the leaf, would not be conveniently placed for examination.

This manipulation may be very conveniently carried on in a deep watch-glass, under a dissecting microscope.

If a slide trough or tube cell be not at hand, the individual so selected may be placed in the ordinary animalcule cage or compressor, and for the highest powers this arrangement is best.

The slide trough arrangement has a great advantage in having the object in a more natural position, and in which it will live the longer. Moreover, when not wanted for examination under the microscope, it may conveniently be transferred to a basin of river water, or still better suspended in an aquarium. In this way an individual may be kept alive for some time, and its life-history watched, and possibly young ones may be propagated and attach themselves to the weed or even to the glass.

When the *Melicerta* is found on myriophyllum, it cannot be better exhibited than by taking a single leaf, placing it on a slip of glass (with ledge) with a little water, cutting off any little fibre of the leaf which might interfere with the examination of the specimens, and then covering them with glass.

In this way it can be viewed with the highest powers, and can be beautifully illuminated with the centrally-stopped parabolic reflector, or with the spot-lens.

The student will find that individuals grown in confinement build their tubes of much more transparent materials, and therefore are much better adapted for examination.

The previous directions, although especially applicable to *Melicerita* and tube-forming rotifers, are applicable to all organisms living attached to weeds. I will next point out the best ways of examining the free-swimming rotifers and infusoria, and afterwards different manipulations applicable to both.

EXAMINATION OF FREE-SWIMMING ROTIFERS, INFUSORIA, &c.

First examine contents of tube, as received, with pocket-lens, in the same way as previously advised with a tube of weeds, &c., and if you have reason to expect there are objects in it with which you are not familiar, and of which it would be well to make certain before the tube is opened, or there can be any possibility of the contents being lost, I should advise that the tube be examined under the compound microscope. This is applicable, whether the organisms are free or attached to weeds; and I often test the contents of the tubes in this way before I despatch them. Of course, if placed directly in the microscope, their round form is awkward to fix, and the aberration of the light is so great as to prevent the possibility of seeing anything with fair clearness, except through the centre of the tube. I have, however, of late, in great measure, overcome this difficulty. I have had troughs made in which the tubes will just go in and lie diagonally. A round tube being placed in such a trough, filled with filtered water, the aberration arising from the cylindrical form of the tube is approximately counteracted, and it is surprising how easily you can examine its contents to the very sides and bottom. If the objects are large enough to be seen without the assistance of a lens, or with a lens of only a low power, they may be picked out at once with a dipping tube and transferred to a live box or compressor. If too small, or too active, to be treated in this way, it may be well to transfer the whole contents into a zoophyte trough of about the same capacity as the tube, for examination under a low power (say 1½ in. objective), but I should generally prefer to empty the tube into a watch-glass for a preliminary examination under a dissecting microscope. I work myself with one of Beck's dissecting microscopes, which is an excellently-arranged instrument for the purpose, but many cheaper ones would be quite sufficient; the only essential is a good steady stage for the support of the watch-glass with plenty of lateral movement, a diagonal mirror under to throw a good light through the object, and ready adjustment for focussing the lens, which should be supported by a long arm over the centre of the mirror and stage. If the observer can work with a watchmaker's glass held under the eyebrow it makes a very good and cheap instrument for the purpose. One of my smallest tubes could be emptied at once into a large watch-glass, but a larger tube would have to be examined in several lots. Large active organisms, such as larvæ, annelids, entomostraca, too large to be readily picked up by a dipping tube, may be removed on the point of a small sable pencil, the quantity of water in the watch-glass having first been mostly drawn up by a capillary tube. A drop of water should previously have been placed on the centre of the live-box or compressor, just sufficient in quantity to allow the animal room to move about naturally; then just touch the drop of water with the point of the sable pencil with which you have picked it up, and it will most likely free itself, or else it must be carefully pushed off the brush by a needle mounted in a short wooden handle.

Smaller objects must be manipulated with the dipping tubes. I now generally use a short curved capillary tube, the upper end of which is blown out into a little funnel, and the end covered with a bit of stretched sheet

india-rubber. A small orifice is pierced in the tube just below the funnel. If the tube is held between the thumb and the second finger, with the thumb (moistened) over the side orifice, the point of the tube placed under a surface of water, the first finger pressed on the stretched india-rubber to expel the air and then withdrawn, a quantity of water will return to fill the tube, and may be expelled again by a touch of the finger. In fact, I often use this means to transfer the water from the tubes to the watch-glass or trough. When it is intended to use a capillary tube to pick out organisms, the inside of the tube should always be first wet in this way, and the outside as far as possible kept dry. Now, having wet the inside of the tube, put the thumb on the orifice and drive out all the water from the point of the tube, then remove the thumb from the orifice, watch the animalcule you wish to catch in the watch-glass under the dissecting microscope, and immerse the point of the tube in the surface of the water just above the animalcule. The capillary attraction in the tube will draw up a small quantity of water with the animal included. It is well to have two or three small shallow watch-glasses at hand. Now close the orifice with the thumb, and by a slight touch of the india-rubber with the first finger you can expel this small quantity of water, with its contained animalcule or animalcules, on your animalcule cage. If at this first dip too much water has been drawn up, it may be pushed out into a watch-glass and a smaller quantity pulled up, and the process repeated till only just sufficient water is taken up as will allow the object sufficient room to assume a natural position. The advantage of this capillary tube over that of the ordinary dipping tube is that you have such perfect control over it, and can expel the small drop from its point by the mere touch of the finger; whereas, in the old way, you had to blow it out with the mouth, entailing the removal of the eye from the dissecting microscope, which sometimes is very inconvenient.

I will now give a short summary of the most useful apparatus for the examination of living objects. The simple glass slip, 3in. by 1in., or better, a ledged stage-plate 3in. by 1½in., with narrow strip of glass cemented along one edge. One of these, with cover-glass, is often all the apparatus necessary to use with small infusoria and free-swimming rotifers, and is also occasionally available with a little management for larger objects, either free or attached. Manipulation with these I cannot better describe than in the words of Judge Bedwell, in his description of what I call Bedwell's rotifer-trap.

"Take a plane glass slide, on it drop one or more of the rotifers in a drop of water, about half an inch in diameter, and draw off the surplus water, if any, carefully with the empty pipette; then fray out a very, very small portion of cotton wool (I always use a watchmaker's glass in the eye to do all such operations) until it is much extended, and spread out and lay this on the drop. Upon that lay the thin microscopic glass, the thinner the better, and then set up the capillary attraction by gently touching it with a needle. Draw off any superfluous water from the edges with the pocket-handkerchief, and you will have a little wilderness of wool in which the rotifer is restrained in its movements, protected from pressure, and within reach of very high powers. The amount of wool depends on the size of the rotifer. *Hydatina* requires more depth than rhinops. The same plan answers equally well for all roving animals. The poduridæ in particular, when placed in deep glass cells, are easily seen by this apparatus, and it saves many a weary and vexatious five minutes with the compressorium, which, even at the best, requires with living animals extraordinary patience. The rotifers are

easily found and secured with the pipette, and a watchmaker's glass in the eye, after a very little practice. Mr. Bolton's studio is of the greatest value to naturalists, and cannot be too well known, for to those who have not time to look for specimens it is a great privilege to be able to purchase them."

Another simple apparatus I call the Wills' compressorium. Most forms of compressorium are useless—all are expensive. Those who try the following will be surprised at the efficiency of the apparatus. Two pieces of thin glass are cemented on to a glass slip in the shape of the letter L, but with the two strokes of the letter about equal in length, and another thinner and longer one is fixed longitudinally, thus L— The L serves to retain in position a square slip of cover glass placed, of course, not on the L, but inside it; the horizontal piece, which should be ground to a bevel on its top edge before fixing it, serves to carry a fine needle, the point of which is inserted beneath the edge of the cover glass. This point being tapered, it is easy to increase or diminish the thickness of a film of water carried between the cover and the slip by pushing the needle further in or out, and so to form a cheap and effective compressorium.

ANIMALCULE CAGE AND COMPRESSORIUM.

The ordinary animalcule cages are often used for examination of entomostraca, larvæ, &c., with transparent light, but cannot be used for dark-field illumination, either with paraboloid or central-stopped condensers. A good compressorium is very useful; I have myself generally worked with R. and J. Beck's parallel compressorium, or their reversible compressorium. A good and cheaper form has just been made under the direction of Mr. Graham, President of our Birmingham Natural History and Microscopical Society, which will be very useful, as it gives a good range of depth, and is readily manipulated.

HOLLOW CELLS.

These are ordinary slips of glass, 3in. by 2in., with a slight hollow ground in the centre, in which a drop of water can be placed and covered with thin glass.

TUBE CELLS.

These are very useful, and can be made by cementing with marine glue or gold size, on ordinary glass slips, either vulcanite, tin, or glass rings. These are filled with water containing the objects for examination, covered with a thin glass cover, which will be retained in its position by capillary attraction.

TUBE-CELL TROUGHS.

Tube cells may be conveniently converted into most useful little zoophyte troughs by cementing a semicircle of thin glass on the lower half of the cell.

THIN GLASS SLIDE TROUGHS.

These are made of glass slips, 3in. by 1½in., to which are cemented slips of thin glass 2in. by 1in., out of which a semicircle of ½in. radius has been cut, and then covered with another thin glass 2in. by 1in. It is well to have an assortment of these, of different thicknesses or depths, and for those of greater depths it is more convenient to make the distance-plates of vulcanite instead of glass. These troughs should always be washed out directly after use, but if dirty are best cleaned under a stream from a water-tap, with a wooden smoking-spill, the thickness of which can be readily reduced, if required, with a knife. In using these troughs, great care should be taken to have the top edge, face, and side, quite dry, as, if in fitting them any moisture is allowed to

remain outside, capillary attraction is very apt to commence and cause the water to escape *over the edge*, especially if any fine fibres of algæ are present, which will often act as syphons. By omission of this precaution such troughs are often condemned as leaking when the fault is in the manipulation; but if a trough is found to leak it should be carefully dried, and the outside edges carefully painted over with one or two coats of gold size. One or two of the ordinary large Zoophyte troughs will also be occasionally wanted for large objects.

GLASS SYRINGES.

In addition to the aforesaid apparatus, a small glass syringe would be found useful for transferring the water to and from the troughs, and another still smaller syringe is easily made by slipping a baby's sucking-bottle teat on the end of a glass tube, the other end of the glass tube being drawn out into a capillary tube.

In examining rotifers and infusoria the student should never omit the use of carmine or indigo. If a little of either of these colours be rubbed up in a little water in a watch-glass, and a little taken up in a brush, and the brush run along the top of the water in a trough, sufficient will be added to barely tinge the water with the colour, which will gradually subside over the rotifers. It will be seen in the microscope like a rising cloud of dust, which as soon as it comes near the rotifers, is whirled round in definite curves, showing at once the action of their wonderful ciliary wreaths. This colouring matter is also greedily devoured by these animals, and may be followed with the microscope down their digestive canal from the mouth to the anus.

If the rotifers or infusoria are in a cell or under a thin cover, a drop of the mixed colour may be placed at the edge of the cover glass, and a piece of blotting-paper touched at the other side will draw a current through the cell.

The cilia and fine flagella on many of the small protophytes and infusoria, which are very difficult to see in their full activity, are easily seen when dying or afterwards from the effect of iodine. Its effect on *Volvox globator*, *Euglena viridis*, and *Protococcus pluvialis* is very interesting, and besides showing the cilia, it brings out many histological characters which are totally invisible without its help.

Aniline dyes are also occasionally useful for the same purpose. Osmic acid is now also often used for killing infusoria quickly in their expanded condition, and they may afterwards be stained advantageously with picrate of carmine (see *Journal of the Royal Microscopical Society*, Sept. 1878, page 189.)

The most useful aquaria for preserving and breeding microscopical organisms I find to be the ordinary confectionery cake-glasses inverted. I have a square block of wood (8in. square) with a hollow turned in the centre to receive the knob. If this is black varnished it looks very well. It should be covered with a round glass to exclude the dust, and is best raised slightly from the edge of the cake-glass by three thin slices of cork cemented with marine glue to the cover to allow a little circulation of air.

Common plain finger-glasses do very well for smaller ones, and I occasionally use the little glass cups made to hold the food and water in bird-cages. The management of the aquaria I cannot enter into; it can only be learnt by experience. The great thing is to hit the medium of enough vegetable and not too much animal life. I can recommend the handbook on the subject published by Mr. Bogue, the "Aquaria," by the Editor of *Science Gossip*.

Illustrations and prices of several parts of the apparatus above referred to will be found inside the cover of my Portfolio of Drawings, No. 2.

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Quarterly Journal of Microscopical Science,

OCTOBER, 1879.

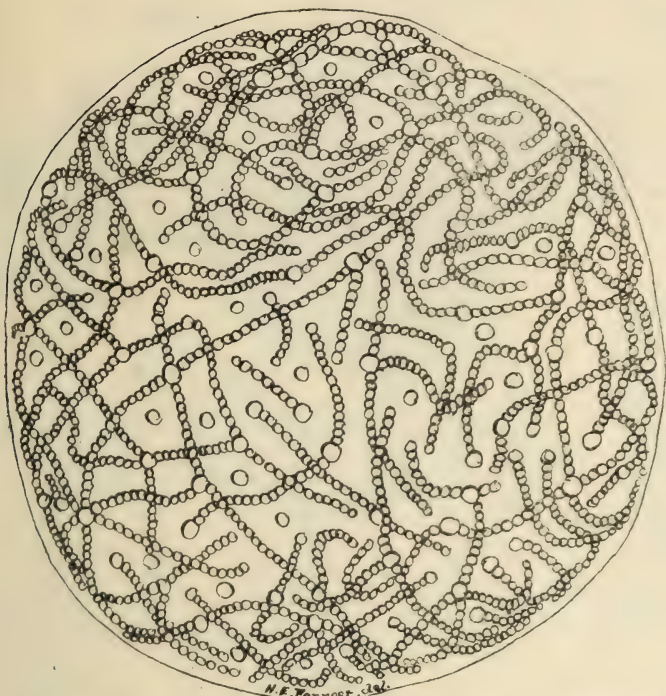
MR. BOLTON'S AGENCY FOR THE SUPPLY OF MICROSCOPIC ORGANISMS.

Mr. Bolton, of 17, Ann Street, Birmingham, has supplied to me once a week, during the past year, a tube containing, in a living state, new or interesting forms of Protozoa, Entomostraca, Rotifera, &c. Every naturalist within a day's post of Birmingham, should subscribe a guinea to Mr. Bolton's agency, and ensure the weekly receipt of one of his most interesting tubes. Mr. Bolton has sent out during the past year most of the more important forms of Rotifera, such as *Hydatina senta*, *Lacimularia socialis*, *Conochilus volvox*, *Melicerta* and *Ecistes*, *Stephanoceros*, and *Floscularia*, &c. One form sent by him, viz., the *Rhinops vitrea* of Dr. Hudson, is especially worthy of mention. Large Amœbæ and the common ciliate Infusoria have been supplied by Mr. Bolton in abundance. Amongst rarer ciliata supplied by him we may mention *Trachelius ovum* and *Zoothamnium arbuscula*. The work which Mr. Bolton is doing is not, however, limited to the distribution of forms already known; he has made some important additions to the British Fauna, for which he deserves the warmest support and encouragement of Zoologists. About three months ago I received from him a tube containing specimens of an Entomostrakon, which he was unable to identify, rightly considering it new to this country. The form proved to be the beautiful *Leptodora hyalina*, of Lilljeborg. A few days later another tube was sent by him containing a species which I identified as the *Hyalodaphnia Kahlbergensis*, of Schödler. These two very fine Entomostraca were obtained by Mr. Bolton from a deep reservoir at Olton. Besides these I have to thank Mr. Bolton for the new Protozoon *Lithamaba discus*, described in the present number of the "Journal." Last autumn, from the same source, I received an abundant supply of one of those very interesting spiculate Heliozoa, which my colleague, Mr. Archer, of Dublin, was the first to make known to zoologists. The specimens forwarded by Mr. Bolton proved to be *Raphidiophrys pallida*, a species named by Professor F. Eilhard Schulze, and assigned by him to Archer's genus.

Mr. Bolton has also during the year supplied me with the finest specimens of *Hydra fusca* which I have seen, with *Volvox*, *Uroglena*, and other similar forms. A few marine organisms have been distributed by him, namely the interesting disk-like larvæ of the Polyzoon *Alcyonidium*, and the delicate polyp *Lucernaria auricula*.

E. RAY LANKESTER, M.A., (Oxon.) F.R.S.,
Professor of Zoology and Comparative Anatomy in
University College, London.

NOSTOC COMMUNE



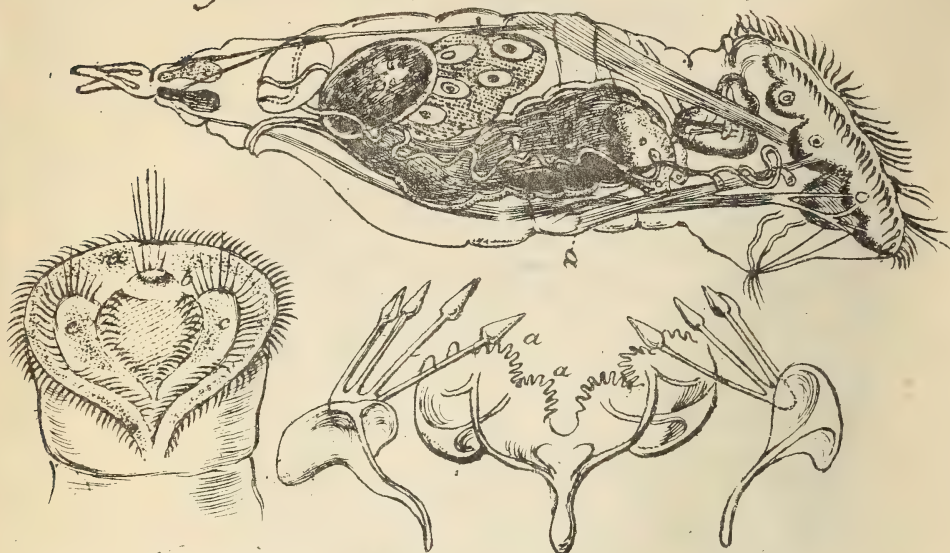
The typical genus of the Nostochaceæ, distinguished from the allied genera by the definitely formed hardened pellicle or rind enclosing the fronds, which are composed of a gelatinous substance in which are imbedded numerous more or less beaded filaments. The filaments are composed of rows of cells which increase the length by repeated transverse subdivision; here and there appear larger cells which appear brighter than the rest; these seem to be what Kützinger calls the spermatia or spermatie cells, but they more resemble the vesicular cells of the allied genera.

The filaments break up after a time into short fragments, which by cell division produce new filaments.

Thos Bolton, 17 Ann Street Birmingham July 16. 1879

— *Hydatina Senta*. —

After Dr. C. T. Hudson. F.R.M.S.



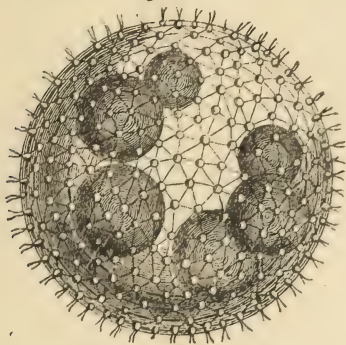
Trochal Disc.

— *Mastax.* —

Hydatina senta one of the Rotifers or wheel animalcule is generally found in company with *Euglena Viridis*. The *Euglenas* are eaten at a rate of several individuals, — I dare not state how many I have seen devoured, for fear of being charged with exaggeration, but let us be content with several a minute, by a large wheel animalcule, *Hydatina senta*, the rough water beast who sucks them into his wide open mouth, much as a codfish would swallow sprats, and instantly crushes them before your eye in the terrible mill which works at the bottom of his throat.

From Household Words Feb 6th 1878
An article entitled
Unsuspected Neighbours

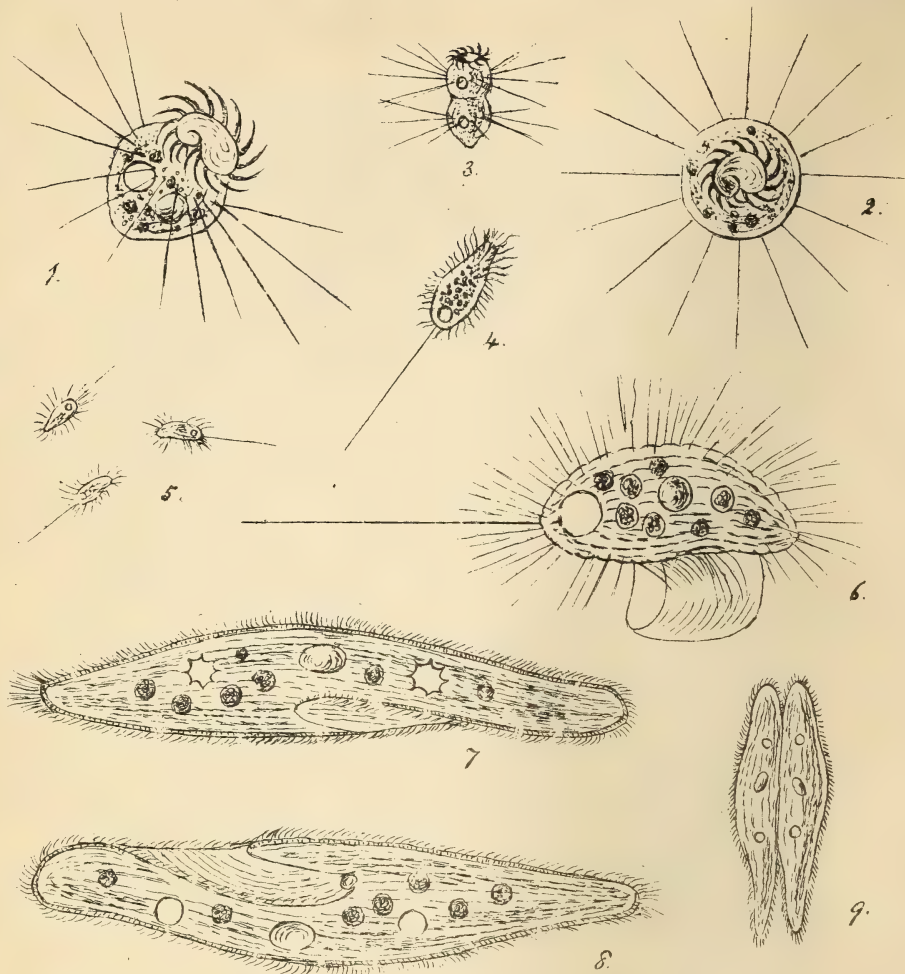
Volvox Globator



The Volvox has been, in its time banded about from the animal to the vegetable kingdom, until its real nature was known. It is now set down as one of the confervoid alga. In the microscope it may be observed rolling through the water in pretty much the same manner that a balloon makes its way across the sky on a still day. Only a low optical power is required to convince the observer that he has in the Volvox one of the prettiest objects it is possible to imagine. It is a globe of the most delicate green color formed of a transparent membrane, which is marked with a net-work of fine lines, ornamented with darker green spots, just where the lines cross. What is most singular is the manner in which the volvoxes reproduce themselves. Within each globe may be seen smaller globes, fashioned precisely like the parent. Even within these enclosed young, not unfrequently you may perceive a third generation in Embryo!

{ Taylor's Half Hours in the Green Land 4 }

Thos Bolton, 14 Ann St. Birmingham.



W. Saville Kent. del.

Infusoria included in "gathering".
received from Mr Thomas Bolton - Feb. 8th 1879.

1. *Halteria grandinella* C. L. x 750. side view.
2. " " " " front view.
3. " " " " dividing by transverse fission.
4. *Urotricha farcta* Pk. x 750.
5. *Cyclidium glaucoma* M. three specimens x 375.
6. " " " " x 1800. showing extensile membrane.
7. *Paramecium aurelia* M. side view x 230.
8. " " " " ventral view.
9. " " " " conjugation of two individuals.

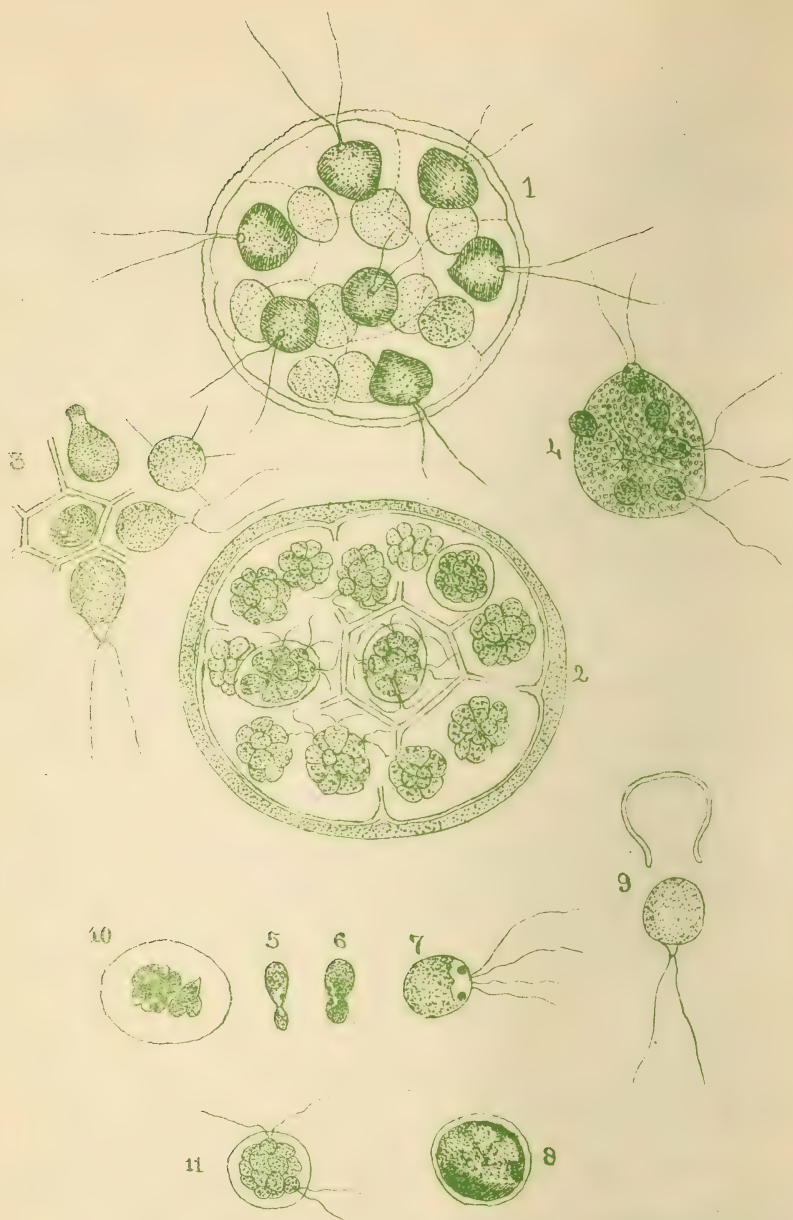
Pandorina Morum,

Pandorina is a minute unicellular alga allied to Volvox. It may be seen in the tube as a minute green speck rolling slowly about in the water. When submitted to the Microscope in a shallow trough or live box it is seen to consist of a hyaline gelatinous ball, in which are included 16 (sometimes 32) zoogonidia. Fig 1 each of which carries two long cilia which project through the envelope, and by their motion roll the whole ball along.

Each zoogonidium by subdivision produces a group of 16 other cells Fig 2 which subsequently break away as distinct colonies. Even after breaking away two or three colonies may frequently be seen attached to each other, and rolling about together. Sexual reproduction begins in the same way, the new colonies separating into zoospores which vary in size Fig 3 female fig 4 male. These conjugate fig 5 & 6 and form one large zygospore fig 7 which is ciliated at first but afterwards becomes encysted fig 8 and of a red color. This ultimately liberates its contents as a large red ciliated zoospore fig 9 and then by subdivision reproduces a colony like the original. Figs 10 & 11 are stages in the subdivision of this zoospore Fig 9

Reverend. May 15th 1879.

Thomas Bolton of Ann St Birmingham.



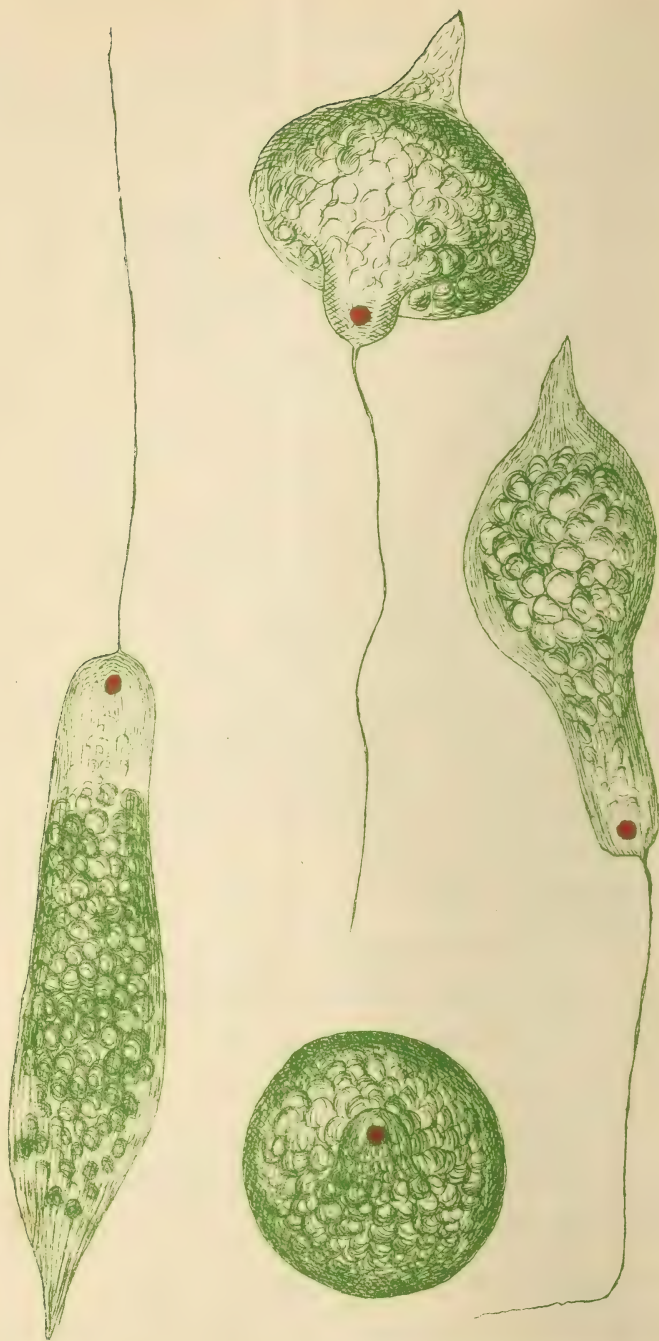
H E Forrest del.

PANDORINA MORUM.
 (After Oersted except figure 1. HEF)

1
The sketch of the *Euglena viridis* on the other side shows specimens in various stages of contraction and the long flagellum by means of which it swims. At the same end as the flagellum it has a red spot, so we must consider this as the head.

The *Euglena* progresses forwards by a sort of quivering motion of the flagellum, & head first. This appears to me rather remarkable, should we not rather expect the quivering of the flagellum to drive the body in the opposite direction, i.e. tail first. It is difficult to see this well as the flagellum is invisible unless stained with Iodine, yet Iodine kills it. The best way is to put a drop of water containing *Euglena* on a slide, lay on this a thin cover glass and remove the superfluous water with blotting paper then put a weedrop of the Iodine solution against the edge of the cover glass & watch the effect with a high power say $\frac{1}{6}$ objective. As the Iodine slowly runs in & comes in contact with first one *Euglena* and then another each becomes gradually stained, the flagellum becomes visible, & its motions may then be easily observed. At first it has a tolerably regular rippling movement, but as the Iodine affects it more deeply this changes to spasmodic twitchings and curlings and at last stops. It assumes a deep purple color and all is over. As the drop of Iodine is a considerable time in penetrating all the slide the process above described may be witnessed in a large number of individuals. It was by this means that I was able to draw the individuals sketched.

H. E. Forest August 1877



H. E. Forrest. del.

EUGLENA VIRIDIS

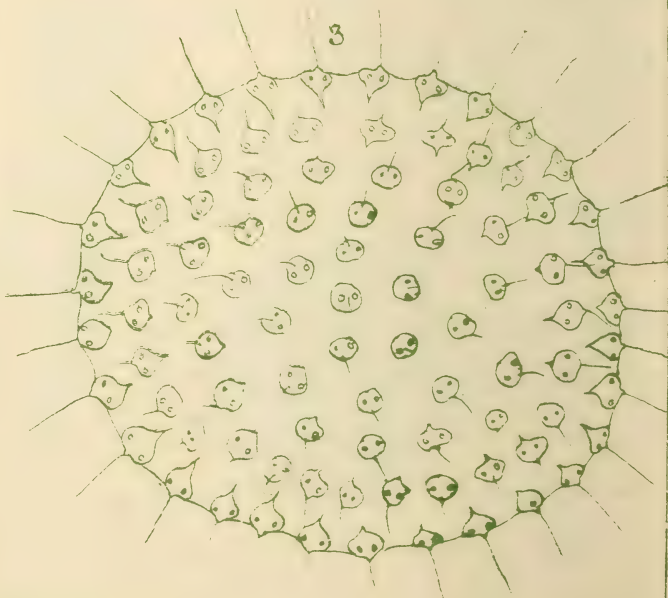
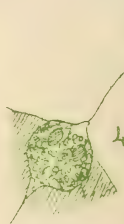
Uroglena Volvox.

To the naked eye *Uroglena* appears as a minute green globule, both in size and colour closely resembling the well known *Volvox globator*, and, like it slowly revolving along through the water. When submitted to the microscope ($\frac{1}{2}$ inch obj) it will be seen to differ from *volvox* in several points.

- 1st. The globes are not perfectly spherical, but exhibit a tendency to tri-partite division (Figs 1 & 2).
- 2nd. The globes are "rougher" looking than in *volvox*, this appearance being due to the fact that the green bodies project beyond the gelatine.
- 3rd. The globes are solid, not hollow.
- 4th. They never contain young globes in their interior, as *volvox* does, but multiply by fission of the parent-globe(?)
- 5th. The individual green bodies are shaped like *Euglena*, and can slightly alter their form (Fig 4 & 5). Each has only a single cilium twice as long as the body; & each has two large red eye-spots. Ehrenberg places it in the same group with *Volvox*, but there is some doubt if it be not an animal.

Thomas Bolton. 109 Ann St. Birmin^g. June 1879.

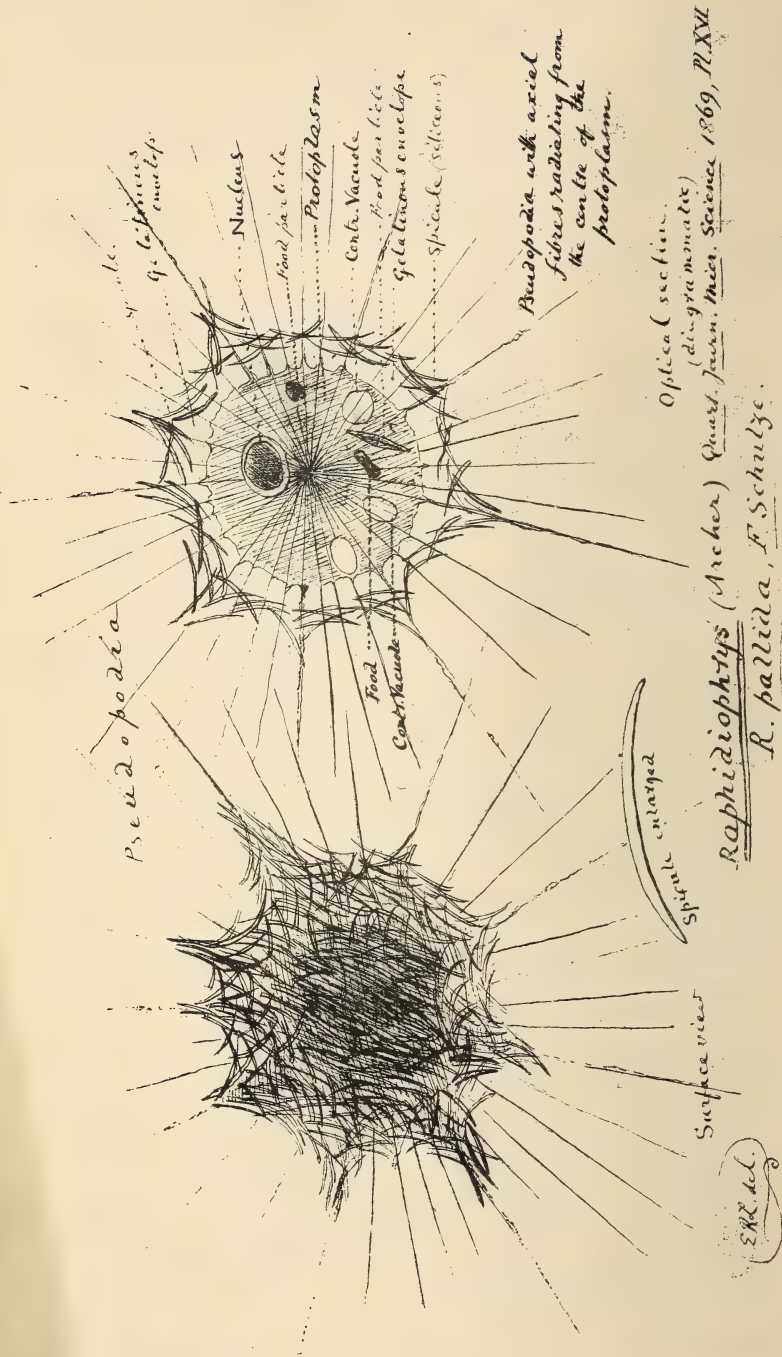
Uroglena Volvox.



Extract from letter of Professor E. Ray Lankester.
The genus *Raphidiophrys* was founded by Mr.
Archer of Dublin who described a fine green
specimen in the *Quarterly Journal of*
Microscopical Science 1869, Plate XVI. It is
characterized by having a single excentric nucleus,
surrounded by dense protoplasm in which
are three or four contractile vacuoles, - outside
this is a gelatinous investment, in this are
embedded slightly curved siliceous spicules
in masses. Delicate filamentous pseudopodia
radiate through the gelatinous coat and as
in *Actinopharium* send fibrous continuations
to a central point in the protoplasm.

This species is colorless, Archer's species is green.
I have seen all these points of structure to day
by treating the specimen on the slide of the
Microscope under cover glass, first with Osmic
Acid, then with Picro-carmin, and then
alternately with glycerine and water. The
glycerine prevents the spicules being seen,
being of the same refractive index, but renders
the protoplasm clearer. The nucleus is only
seen well after staining. The form is highly
interesting, and one I was very glad to see.

Pray send me any more such things
which may turn up.



THE MOST BEAUTIFUL OF ALL THE ROTIFERS.

THE STEPHANOCEROS EICHHORNII,

The Crown Animalcule,

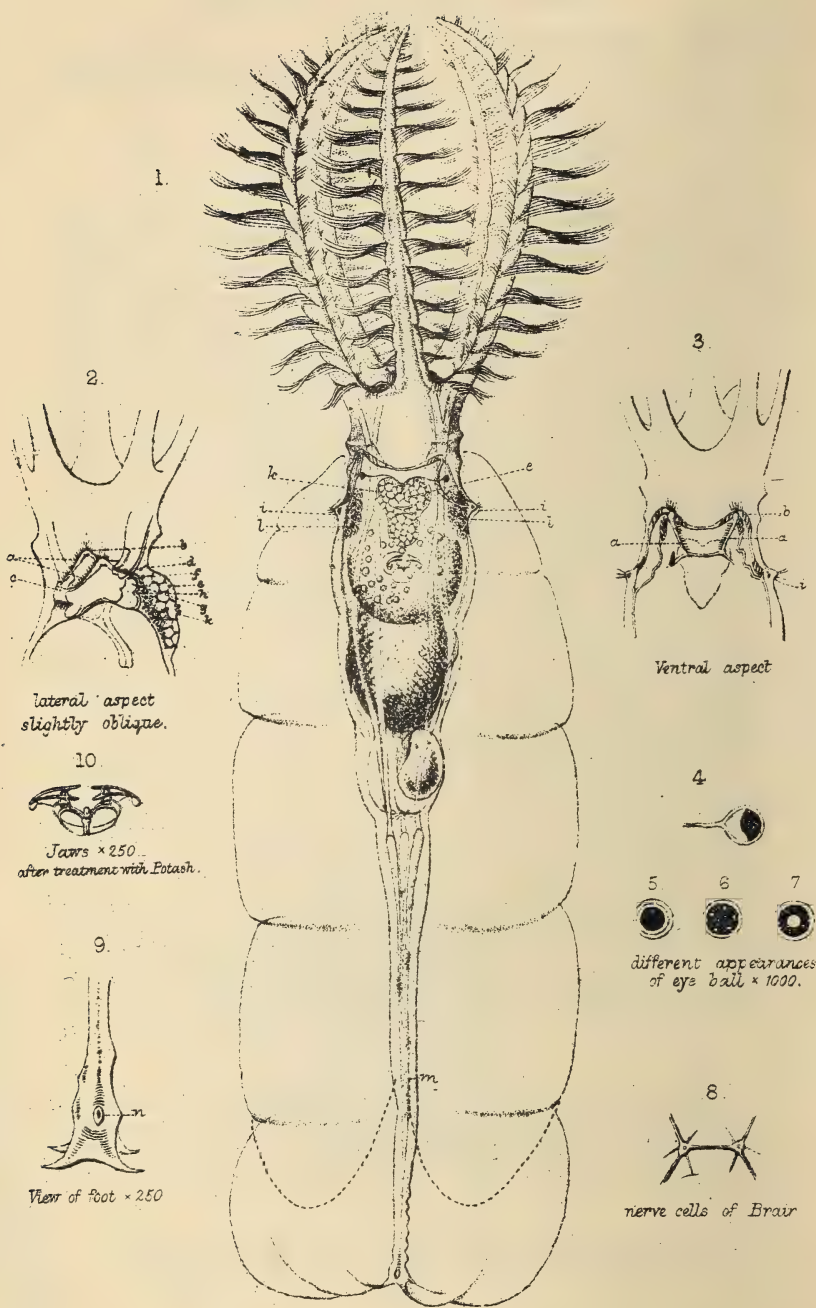
"In this elegant creature an oval body, somewhat expanded at the top, is supported upon a tapering stalk, and stands in a gelatinous bottle, composed of irregular rings superimposed one upon the other, as if thrown off by successive efforts, the upper ones being inverted and attached to the body of the animal. But that which constitutes the glory of this little being is the crown of five tapering tentacles, each having two rows of long cilia arranged on opposing sides, but not in the same plane. The ordinary position of the tentacles is that of a graceful elliptical curve, first swelling outwards, then bending inwards, until their points closely approximate, but each is capable of independent motion, and they are seldom quiet for many minutes at a time. The cilia can be arranged in parallel rows or in tufts at the will of the creature, and their motion appears under control, and susceptible of greater modification than is exhibited by the ordinary infusoria. * *

* * * Like the Floscule, the Stephanoceros only reveals her beauties under careful illumination. A direct light renders them invisible, and only when the requisite obliquity has been obtained, does the exquisite character of the structure become displayed. The dark-ground illumination is very useful, and makes the ciliary action very distinct. At times a view can be obtained, in which the cilia of perhaps a single tentacle are all ranged like the steel springs of a musical box. For a moment they are quiescent, and then they vibrate in succession, each moving thread sparkling in the light. With a clumsy mode of lighting them, the cilia look like stumpy bristles, and are often so drawn; but precisely the right quantity of light coming in the right direction makes them appear more numerous, and much longer than would at first be supposed. When well exhibited the tentacles have a lustre between glass and pearl; the body, in a favourable specimen, is like a crystal cup, and the food, usually composed of small red and green globes, glows like emeralds and rubies, as if in the height of luxury the little epicure had more than rivalled Cleopatra's draught, and instead of dissolving, swallowed its jewelry whole."—*Extract from Slack's Marvels of Pond Life. Lately reprinted. Price 3s. 6d.; Post-free, 3s. 10d.*

GOSSE gives an interesting illustrated paper on this Rotifer in the *Popular Science Review*, Vol. I., (1862,) page 26; and CUBITT some observations upon it in the *Monthly Microscopical Journal*, Vol. III., (May, 1870,) page 240. The sketch on the other side is copied from Mr. Cubitt's admirable drawing.

SPECIMEN ONE SHILLING. POST FREE.

THOMAS BOLTON, 17, Ann Street, Birmingham.



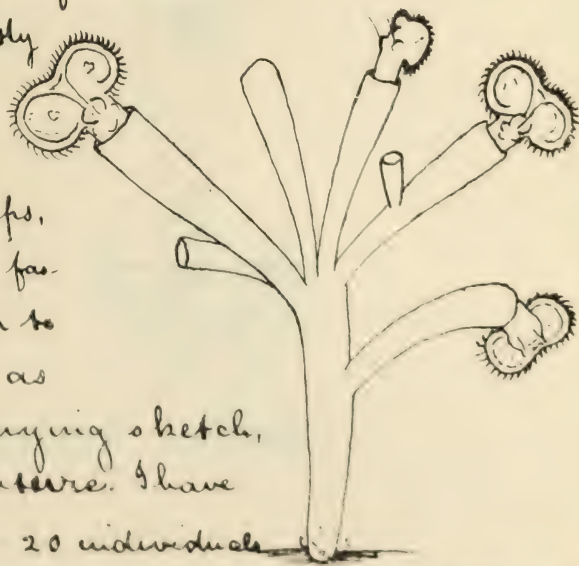
Stephanosceros $\times 100$
Dorsal aspect.

Limnias ceratophylli

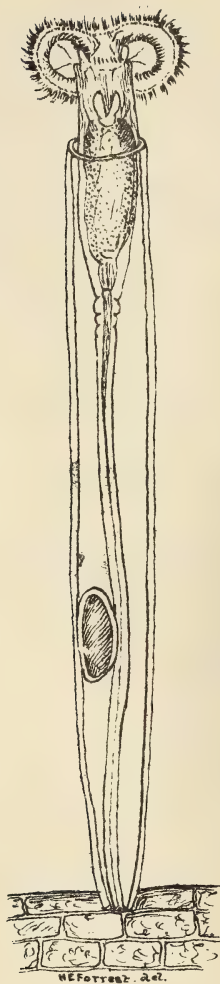
This rotifer bears a considerable resemblance to the melicerta familiar to all microscopists. It is enclosed in a long ureolus, or sheath, transparent in young specimens but becoming brown with age from the quantity of foreign matter which clings to its viscid surface. The tube is smooth externally and as in melicerta.

and of large size. The other side is enlarged from the one given in Pritchard's Infusaria.

Limnias frequently shows a tendency to collect into shrub-like groups, one individual fastening its case on to that of another, as in the accompanying sketch, drawn from nature. I have seen as many as 20 individuals thus grouped together.

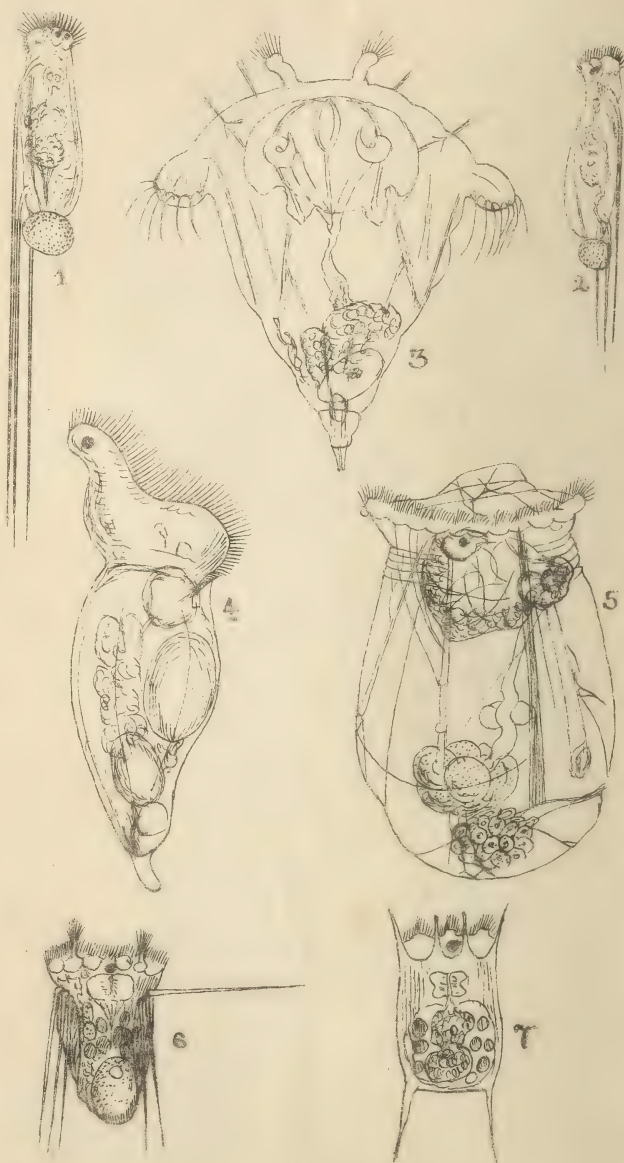


H. E. Forrest



LIMNIAS CERATOPHYLLI.

The seven species of Rotifers drawn on the other side were all found in one gathering of water in a pond. Fig 1 is *Brachionus longisetus* a curious looking animal mounted on three enormous stalks, which it now and then kicks out sideways so as to jerk its body along & swim rapidly, and usually carries a single egg just above its tail setae. (See Monthly Micro Journal March 1, 1869) *Brachionus mystacina* (Fig 2) has the spine barely longer than the body. Both these species are infested by a minute globular parasite (Fig 3) *Synchaeta mordax*, with an ear-like lappet on each side of the body; only one specimen seen (see MS July 1869) Fig 4 *Rhincops vibron* is plentiful. It has a hood of projecting hood carrying its two eyes. Perhaps the most interesting rotifer in the whole lot is, a very large bag-shaped fellow with no foot and a very transparent body, in which the family arrangements are plainly visible; quite one half of her body being filled with eggs, or sometimes with hatched embryos; her name is *Asplanchna Brightwellii*. The muscles which move its body & ciliary wreath are seen with beautiful distinctness through its glassy body, and can be seen work along it suddenly withdraw its head completely into the body, the edges of which are then minutely wrinkled. Fig 5 *Hydradula platyura* Fig 6 *Amphileta aeneasana*. HES.



HEFORREST. del.

I have this week, owing to the kindness of a correspondent at Chester, the pleasure of sending to my subscribers a tube of water rich in rotifers, especially of the active rover Syncheta mordax of which I give copy (on the other side) of D'Hudson's drawing in the Monthly Microscopical Journal (July 1870), where he gives a most interesting and detailed paper on this rotifer.

My friend says he sends me some Syncheta soup flavoured with Rhinops and Anuraea.

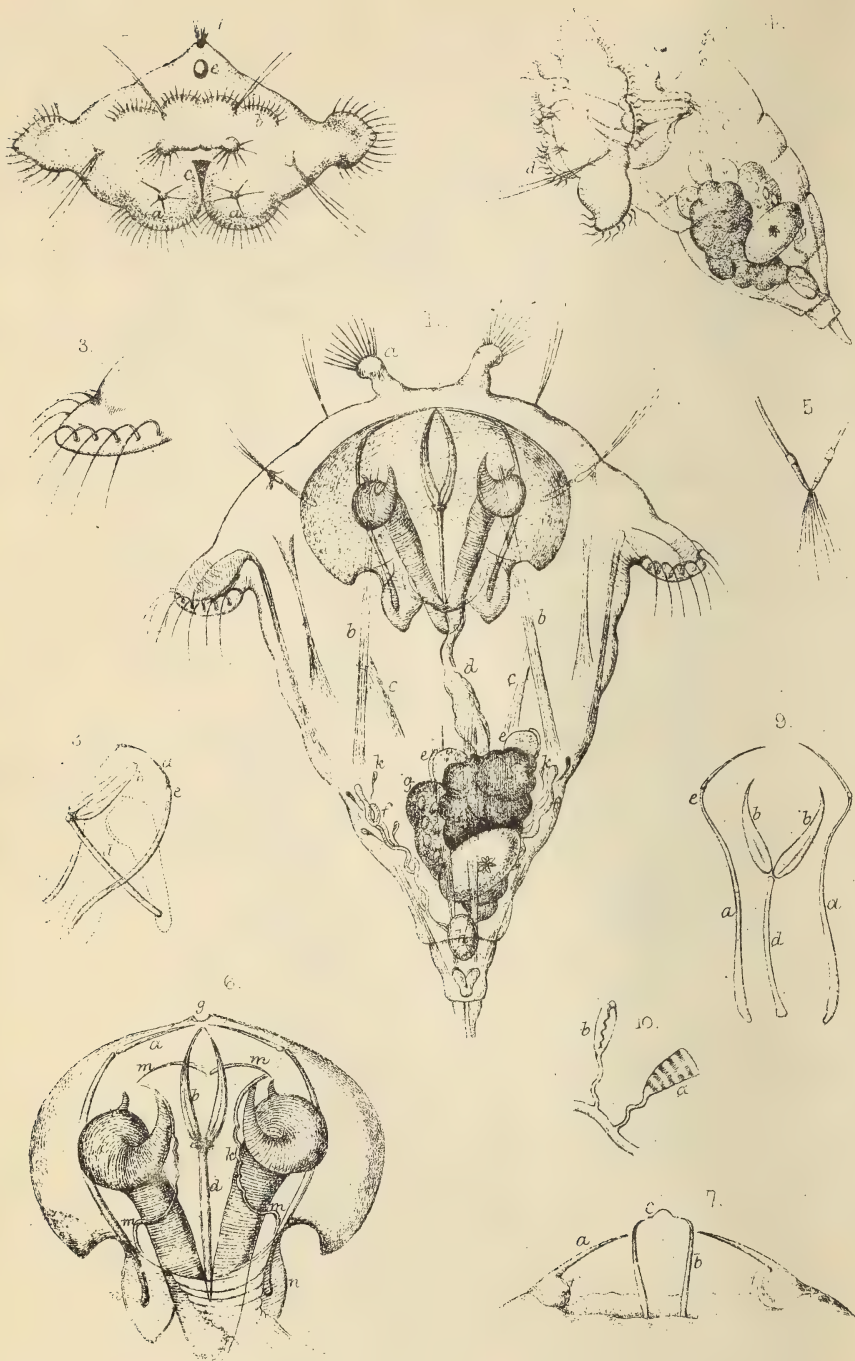
This I think is an appropriate description, so full is it of life, and these latter rotifers are abundant. The Rhinops will be recognised by the sketch and description I have previously sent out. The Anuraea (possibly A. squamula) is a small footless & shielded Brachionea, with single and conspicuous eye spot, six spines on the anterior portion of its oblong lorica two diminutive spines on the posterior portion of the lorica. Many of these carry an egg under the recurved posterior of the lorica. If one of these is carefully fixed in a compressorium, its internal organism will be nicely seen with a $\frac{1}{4}$ or $\frac{1}{8}$ " objective.



I will give short extract from D'Hudson's paper on the Syncheta descriptive of its movements, I am only sorry I have not space for more.

"When it is swimming in ample space it turns end on end in a track regularly curved just like a corkscrew, varying this occasionally by swaying in semi-circles from side to side like a skater; more rarely still it will lay hold of something with the forceps of its foot and then spin round its longer axis; and once or twice I have seen it hovering in one spot like a fly over a flower, while its cilia were all the while lashing the water with a fury which rendered them under a dark field of illumination a mere halo round each lobe."

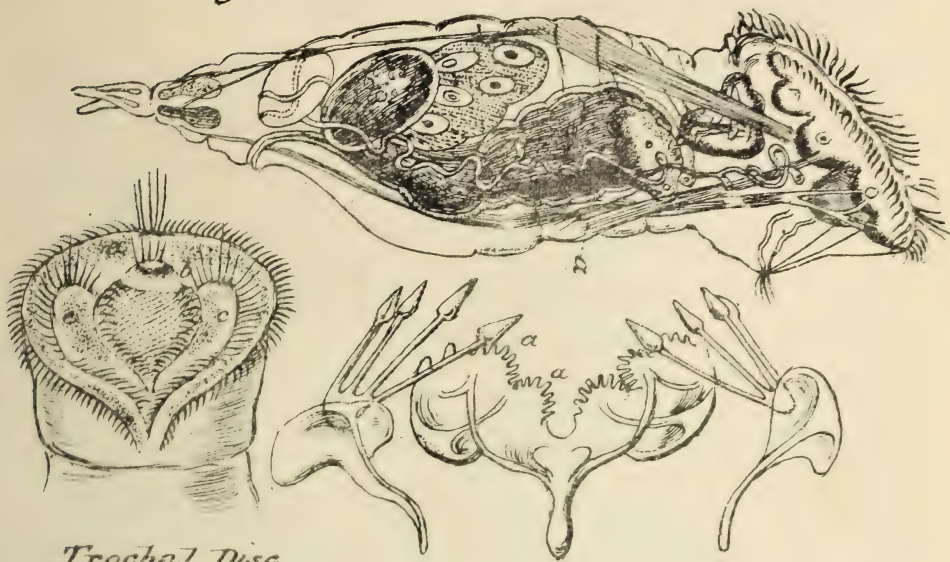
Thos Bolton, 17 Ann St. Birmingham April 4 1879



Synchaeta mordax

— *Hydatina Senta.* —

After Dr. C. T. Hudson. F.R.M.S.



Trocha Disc.

— *Mastax.* —

Hydatina senta one of the Rotifers or wheel animalcules is generally found in company with *Euglena Viridis*. The *Euglenas* are eaten at a rate of several individuals, — I dare not state how many I have seen devoured, for fear of being charged with exaggeration, but let us be content with several a minute, by a large wheel animalcule, *Hydatina senta*, the rough water beast who sucks them into his wide open mouth, much as a codfish would swallow sprats, and instantly crushes them before your eye in the terrible mill which works at the bottom of his throat

From Household Words Feb 6th 1878
 an article entitled
 Unsuspected Neighbours

Rhinops Vitrea

Described by C. J. Hudson. LL.D. in the *Annals and Magazine of Natural History*, January 1869 as a New Rotifer. He says, the proboscis is ciliated all over its ventral surface and its edge except at its extreme point, it carries also two brilliant ruby eyes". "Rhinops usually swims at a moderate pace, rolling gently round its longer axis as it goes, and every now & then it bends its proboscis over towards its back (thus fully displaying the cilia), and turns somersets, as *Synchaeta* does, only in a much more leisurely manner, Occasionally, however, it darts suddenly forward and at each time that I have watched it doing so, I have fancied that I saw the atom which it wished to secure, certainly the impression produced on my mind was that the animal made a conscious effort to seize prey of whose presence it was aware; and it is the first Rotifer whose actions would lead me to credit its red spots with being eyes". F. A. Bedwell. Esq.

R.M.S. County Court Judge writes me, May 21, 1878, "I have been perfectly enchanted with the *Rhinops*, The eye is simply diabolical when on the black field. They glare at you like two railway lamps sailing about."

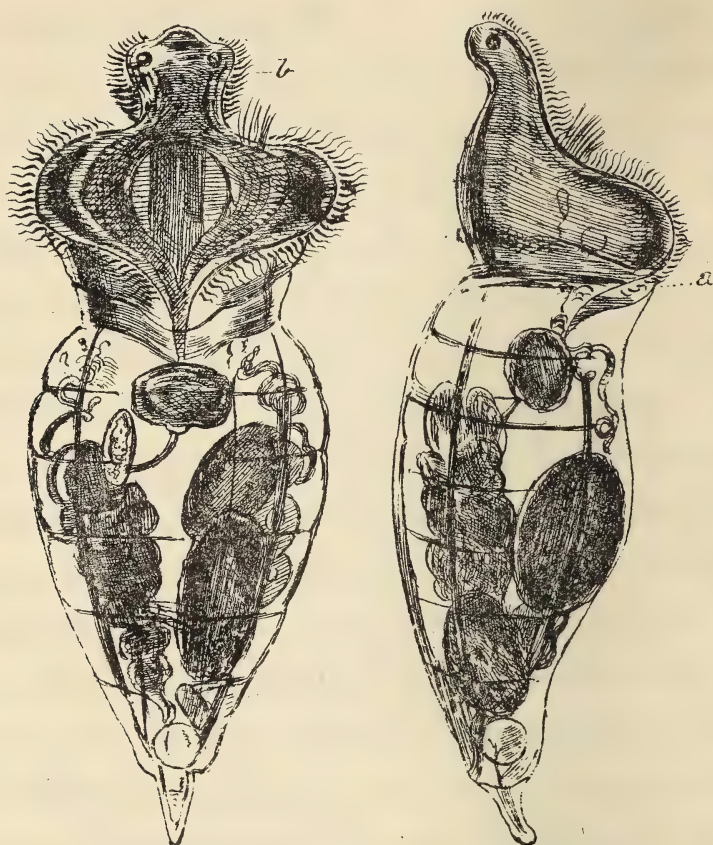
Thomas Bolton

May 30th 1878

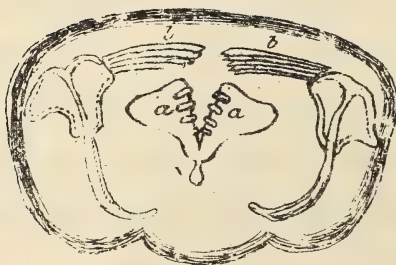
17 Ann St

Birmingham

Rhinopus Vitrea
 After Dr C T Hudson F.R.M.S.



Ventral Aspect. Lateral Aspect
 A B



Maxillae.



*Proboscis
 shewing Eye
 and Nervous Mass.*

Philodina roseola.

Char: Eyes two situated on the neck; tail-like foot, with horn-like lateral processes, color reddish eyes oval.

This is a common species, and at first sight might be easily mistaken for *Rotifer vulgaris*, from which however it is distinguished by the eyes being upon the neck instead of on the proboscis.

Some very interesting notes on the capability of this rotifer to bear desiccation, without being killed appeared in the Monthly Microscopical Journal of May & June 1843. They are too long to quote here but may be summed up as follows. - *Philodina roseola* may be heated gradually up to 200°F , or placed in the receiver of an air-pump, and the air exhausted, and when taken out may yet revive. They may be kept dry for one or more years without harm, or exposed to the broiling heat of a summer sun, but are killed by a temperature of 300° . These curious facts are said to be accounted for thus - The *Philodinae* in drying constantly give off a stinky secretion which solidifies and forms a completely water-proof coat which prevents their bodies being dried up.

Thos Bolton, 14 Ann St. Birmingham



Philodina Roseola

I send you in the enclosed tube a rich collection of "Pitcher Rotifers" 1
~~Brachionus pala~~, and *Brachionus urceolaris*, the former figured on the other
side. The latter has its anterior margin of the lorica or shell armed with six
short spines instead of the four, characteristic of *B. pala*.

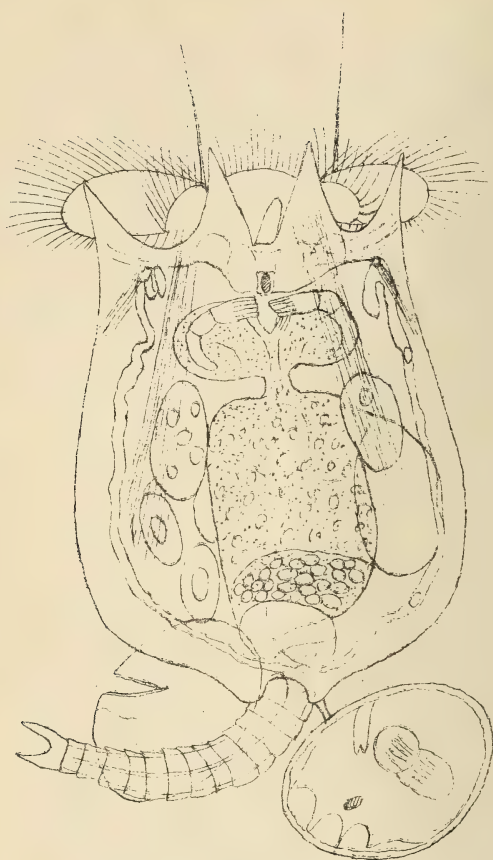
For their examination I recommend you to follow Mr. Bedwells plan described in
"Hints to workers with the Microscope", accompanying this, but for cotton wool
substitute a bit of the green filamentous algae which I have enclosed in the tube.

The main characteristic of the *Brachiones* is a cup of pitcher shaped lorica,
which is cut or notched at the top into several horns or projections, the number of
which indicates the species, while two or more similar projections ornament the
bottom. This lorica is like shell of a tortoise open at both ends from the top and
extremely beautiful wreath of cilia is protruded, and also some longer & stiff cilia or slender
spines, which do not exhibit the rotatory movement. The ciliary apparatus is in reality
continuous, but it more often presents the appearance of several divisions and the
lateral cilia frequently hang over the sides. From the large size of each cilium they
are very favourable creatures for exhibiting the real nature of the action, which gives
rise to the rotatory appearance, and which can be easier studied than described.
By movements partly from their base, and partly arising from the flexibility of
their structure the cilia come alternately in and out of view, and when set in a circular
pattern the effect is amazingly like the spinning round of a wheel. The internal arrangements
of the *Brachiones* are finely displayed, and they have a most aldermanic allowance of
gizzard, which extends more than half way across each side of the median line,
and shows all the portions described by Mr. Gosse. As the joints of this machine move,
and the teeth are brought together, one could fancy a pound of mill work was heard,
and the observer is fully impressed with a sense of mechanical power.

When the creature is obliging enough to present a full front view, her domestic
economy is excellently displayed. Just over the gizzard blazes a great red eye, of
a square or oblong form, and it reposes on a large mass of soft granular looking
brain, which well justifies Mr. Gosse's epithet "enormous". Whether this brain is highly
organised enough to be a thinking apparatus, we do not know, but it is evidently the
cause of a very vigorous and consentaneous action of the various organs the *Brachione*
possesses. A description of the *Brachione* would be very incomplete if it omitted that
important organ the tail, which in this family reaches the highest point of development.
It is a powerful muscular organ, of great size in proportion to the animal, capable of
complete retraction within the carapace, and of being exerted wholly or partially, at will.
It terminates in two short conical toes, protruded from a tube like sheath, and capable of
adhering firmly even to a substance so slippery as glass. This tail may be observed to make a
variety of emotions, if we can attribute such feelings to a rotifer, & it answers many purposes.
Now we see it cautiously thrust forth & turned this way and that, exploring like an
elephant's trunk, & almost as flexible. Now it seizes firm hold of some substance
& anchors its proprietor hard & fast. A few moments afterwards it lashes out right
& left with fury like the tail of a cat in a passion, & is exact from Slacks & Marvels of Pond Life.

3108 Bolton, 41 New St. Birmingham.

Price Post free for 3/6



Egg.



Young



Jaws

NE Forres. del.

Brachionus Pala

PALUDICELLA EHRENBergi,

Van Beneden.

Specific character. — Coenœcium membrano-corneous, branched; branches composed of a series of claviform cells placed end to end and separated from one another by complete septa; orifices tubular, lateral, placed near the wide extremity of each cell. Lophophore orbicular, no epistome or calyx. Statoblasts not observed.—Allman.

This was first found in this locality on the 29th of April, 1877, near the Canal Locks, next beyond Tarvin Road Bridge. It was afterwards found in the same place in May and August, in company with *Cordylophora lacustris*, and a host of microscopic organisms. I again found it there early in March this year, (1878,) when it had the appearance described (as below) by Van Beneden, but which Prof. Allman had not witnessed in any specimens found in Great Britain.

“Van Beneden thus describes the occurrence of ‘*hybernacula*’ or *gemmæ*, which, under the influence of a favourable temperature, would have grown into the ordinary lateral branches of the Polyzoon, but which, towards the commencement of winter, acquire a conical form, and then become for a while arrested in their development. In this state they remain until the following spring, when the investing membrane splits to allow of the elongation of the branch.”

No Statoblasts having been observed in *Paludicella*, it appears highly probable that their place is supplied by the *Hybernacula*, thus described by Van Beneden.

Late in October, 1878, I found some living colonies of this species in the canal, near to Backford Bridge.

If *Cristatella* is (as it deserves to be called) the Queen of Polyzoa, this form, as an infant in comparison, although quite unlike it in form, may with propriety be named The Princess, as from its coy shyness, its delicacy of texture, its beauty of form, its quick playful habits, and its well-marked distinction from all the other species, entitle it, I think, to the second rank. Those only who have patience to thoroughly watch its habits, can at all appreciate its beauty and loveliness. Prof. Allman well describes it as an exceedingly timid little animal, and a specimen may be for hours under observation before the polypides will venture to issue from their cells, and then it is often for only a few seconds at a time that they will continue visible.

Those who may take an interest in this branch of Natural History will find this species, with many others, beautifully described and illustrated by Prof. Allman, in his “Monograph of the Fresh-Water Polyzoa,” published by the “Ray Society.”—*Extract from a paper on “Fresh-Water Polyzoa found in the Neighbourhood of Chester,” by T. Shepheard, published in the proceedings of the Chester Society of Natural Science, Part II., 1878.*

Figs. 1 and 2. Reduced from Prof. Allman's drawing. Polyzoon, just emerged from the split-up *Hybernaculum*.

Fig. 3. Drawn from life.



Fig 1



Fig 2

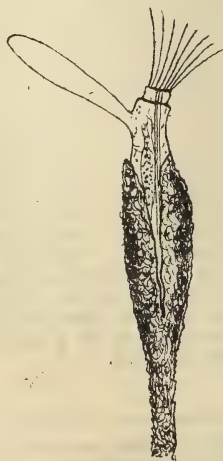


Fig 3

H. F. Perreot del.

PALUDICELLA EHRENBergi.

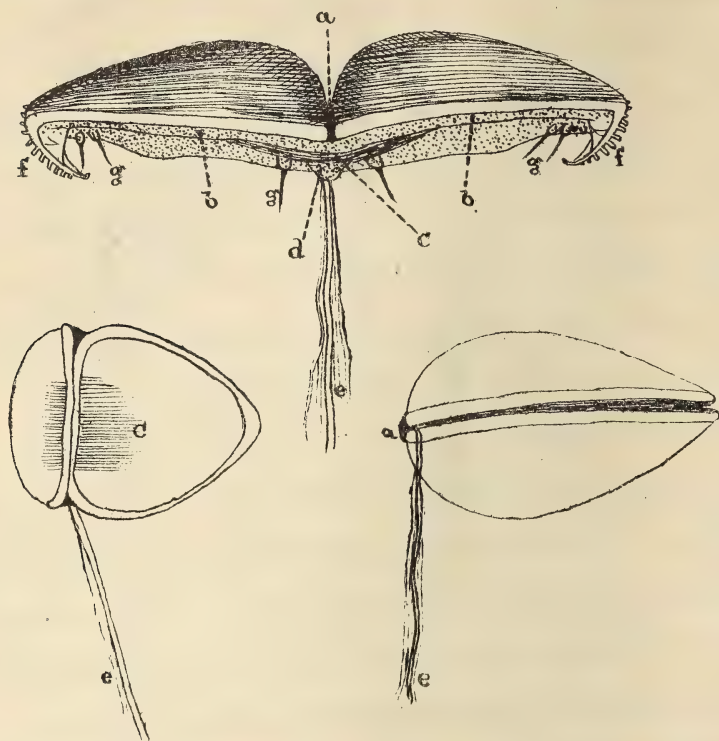
Extract from Huxley & Martins Biology in reference to the ova Anodonta Cygnaea.
When fully formed, multitudes of these ova pass out of the oviducal aperture and become lodged in the chambers of the gills, particularly the external gill, which is frequently completely distended by them. Here they are hatched, and give rise to embryos, which are so wholly unlike the parent Anodonta, that they were formerly thought to be parasites, and received the name of Glochidium. The embryo Anodonta is provided with a bivalve shell. Each valve has the form of an equilateral triangle united by its base with its fellow, by means of an elastic hinge, which tends to keep the two wide open. The apex of the triangle is sharply incurved and is produced into a strong serrated tooth, so that when the valves approach, these teeth are directed towards one another. The mantle is very thin, and the inner surface of each of its lobes presents three papillae, terminated by fine pencils of hair-like filaments. What appears to be the oral aperture is wide, and its margins are richly ciliated. There is a single adductor muscle and a rudimentary foot from which one or two long structureless filaments, representing the byssus of the sea-mussel proceed. These byssal filaments become entangled with one another and tend to keep the "Glochidia" in their places. After a time the larval Anodonta leave the body of the parent, and attach themselves to floating bodies — very commonly to the tails of fishes — by digging the incurved points of their valves into the integument in the latter case, and holding on by them as if they were pincers. In this situation they undergo a metamorphosis; the gills are developed, the foot grows, the auditory vesicles become conspicuous in it, and the young Anodonta at length drops off and falls into its ordinary habitation in the mud.

Thomas Bolton.

April 14th 1849.

14 Ann St. Birmingham.

EMBRYO OF FRESH-WATER MUSSEL (ANODONTA)



a Elastic ligament

b Pallium or Mantle

c Adductor muscle.

d. Rudiment of foot.

e Byssus.

f Recurved hooks.

g Spines.

H E Forrest. del.

LARVA OF CORETHRA PLUMICORNIS.

This wonderfully transparent larva of a dipterous insect will repay the careful study of the best Microscopists. A good drawing of it, with descriptive paper, appeared in "The Popular Science Review," 1865, by Professor E. Ray Lankester, F.R.S., and on the other side I have copied a still later drawing by Professor Rymer Jones, and below I give the explanatory references to the figures in this plate.

The student should not omit to examine the larva under polarized light.

Photo-Lithograph of the drawing, illustrating Professor Rymer Jones's paper on the Structure and Metamorphosis of the Larva of *Corethra plumicornis*, from the "Quarterly Journal of Microscopical Science," 1867.

Fig. 1.—Larva of *Corethra plumicornis* representing the general arrangement of the viscera, and the position of the air-vesicles, sketched under the compressor, and magnified sixty diameters.

Fig. 2.—Pupa of *Corethra plumicornis* as seen under the compressor shortly after its change from the larva condition. The air-vesicles have disappeared, the anterior pair having been converted into the respiratory tubes—0' 0'. The now largely developed tracheal system seems to be entirely derived from the disruption of the two pairs of air-vesicles, the lacerated remains of which may be seen scattered throughout the cavity of the body and adhering in the shape of small patches of black pigment to the walls of the lateral tracheæ. The ganglionic nervous system of the dorsal vessel is largely developed, and the masses composing the ventral series of ganglia of great proportionate dimensions. From the opacity of the thoracic region it was impossible to see whether any changes had occurred in the condition of the proventriculus and muscular gizzard.

Fig. 3.—Represents the head and apparatus of jaws of the larva of *Corethra plumicornis* as seen under the compressor, magnified about 200 diameters. The proventriculus is inverted and protruded from the mouth together with the muscular gizzard *f*, and the narrow tube *g*, whereby the latter viscus originally communicated with the ventricular portion of the alimentary canal; a nervous plexus, and a few ganglionic centres are seen in the muscular walls of the proventriculus. The same letters of reference indicate corresponding parts in all the three figures.

- | | |
|--|---|
| 1.—1st pair of oral appendages. | <i>h</i> .—Ventricular portion of alimentary canal. |
| 2.—2nd ditto ditto. | <i>i</i> .—Pylorus and insertion of |
| 3.—3rd ditto ditto. | <i>k</i> .—Hepatic cæcal tubes. |
| 4.—4th ditto ditto. | <i>l</i> .—Small intestine. |
| 5.—5th ditto ditto. | <i>m</i> .—Large intestine. |
| 6.—6th ditto ditto. | <i>n</i> .—Anal aperture. |
| 7.—Auxiliary spikes, situated beneath the mouth. | <i>o</i> .—Air-vesicles, subsequently converted into 0, dorsal respiratory tubes, and |
| <i>a</i> .—Encephalic masses of the nervous system. | <i>p</i> .—Tracheal system. |
| <i>b</i> .—Conglomeration of eyes. | <i>q</i> .—Dorsal vessel, to the different compartments of which are appended |
| <i>c</i> .—Ocellus detached from the principal organs of vision. | <i>r</i> .—Nervous ganglia of the heart. |
| <i>d</i> .—Ventral chain of nervous ganglia. | <i>s</i> .—Rudimentary ovaries. |
| <i>e</i> .—Proventriculus. | <i>t</i> .—Nerves and ganglionic masses in the muscular walls of the proventriculus. |
| <i>f</i> .—Gizzard. | |
| <i>g</i> .—Slender canal leading from the gizzard to | |

I send out to my Subscribers with this several specimens of young larva, one fully advanced, and a pupa; and if any of my Subscribers wish to follow up the study of the species, I expect to be able to supply more specimens of the larva, and also the mature insect.—June 13th, 1879.

THOMAS BOLTON, 17, ANN STREET, BIRMINGHAM.



Spawn of Perch (?)

1

I am not sure to what species of fish this spawn belongs, but believe it to be that of the Perch. The embryo is plainly visible, though not yet sufficiently advanced to afford any evidence, from the position of its fins, as to its species. It shows the heart and circulating apparatus very well, and this is exactly like that of the trout which I have described and figured before. Just at the point where the yolk-sac is attached to the throat of the embryo, there is a small bubble of air, which I have not noticed in other fish ova. But the most striking peculiarity of the specimens figured on the other side is the radial striae in the albuminous sheath of the egg. The whole outer membrane is completely filled with them. They are shaped like pins, and are arranged with their "heads" outwards, and their points towards the centre of the egg. In some lights they appear to be hollow. Query: what are they, and what is their function?

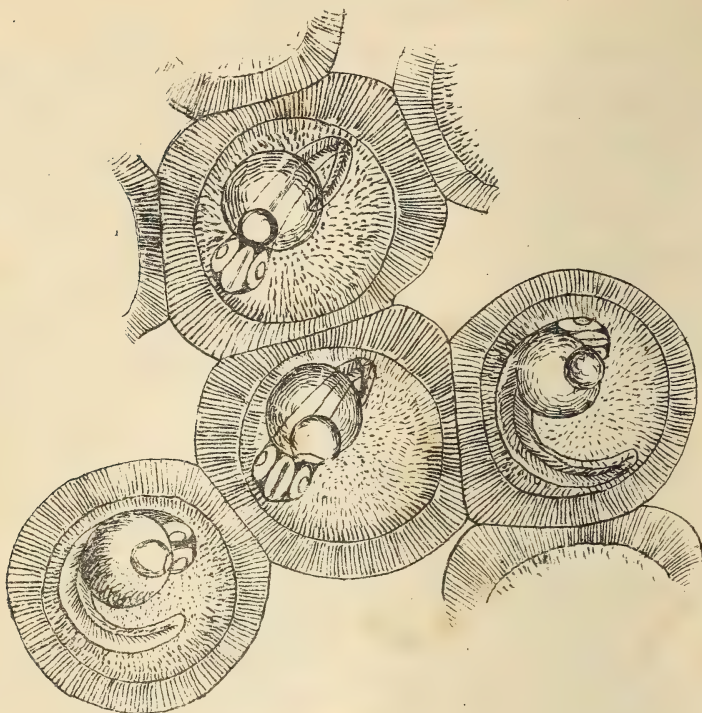
H. E. Forrest.

Thos Bolton, 17 Ann Street, Burn^m.

May 9th.

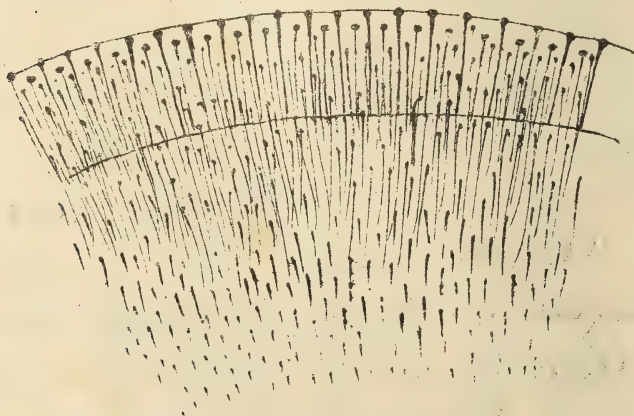
SPAWN OF PERCH (?)

x 10 diameters.



Portion of albumen to show stria

x 600 dia.

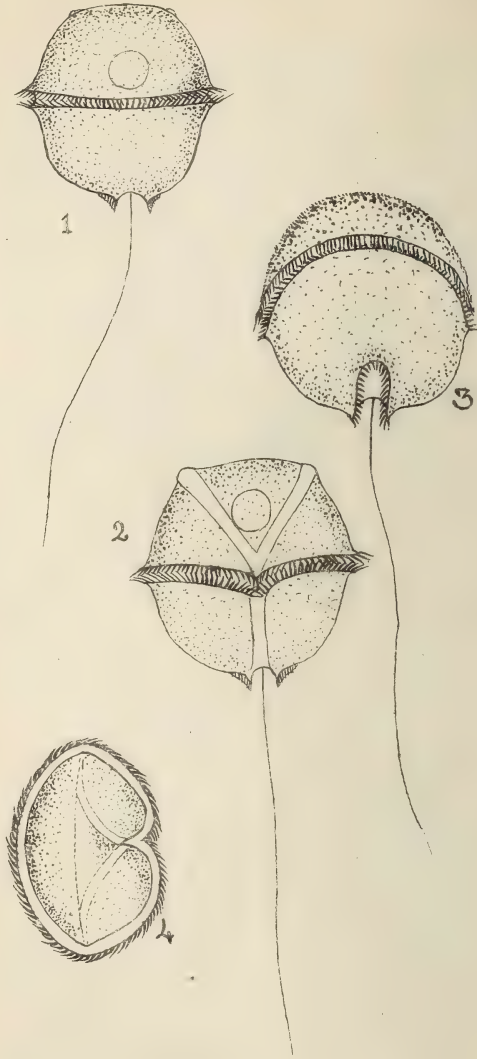


H E Forrest. del.

Peridinium tabulatum?

These Infusoria although tolerably common are very difficult to make out. They are rather pale of a greenish or yellowish brown colour, and in shape somewhat resemble a chestnut, being rounded on the one side and flattened on the other, and pointed at one end.

Fig. 1 shows the rounded side. Fig. 2 the flattened side. Fig. 3 is the same as fig 1 but slightly tilted up. Fig 4 is the same as fig 2 viewed vertically from above. A deep furrow encircles the body, the edges of which are ciliated. Another furrow runs at right angles to this to the bottom edge where it terminates, the raised edges forming two short horns. To the end is attached a long flagellum. The animal moves forward with a rolling motion. The revolving motion being produced by the cilia along the furrow, the forward motion, by the vibration of the flagellum. Two ridges pass diagonally upwards from the centre to the two upper corners (fig 2) and a transparent vesicle is visible in some specimens (fig 1 & 2) probably contractile. I cannot satisfy myself as to whether the ridges are ciliated or not. Length $\frac{3}{1000}$ inch. R.E. Forrest & P. Bolton, 17 Ann St. Birmingham. Nov. 28/79



Peridinium tabulatum.

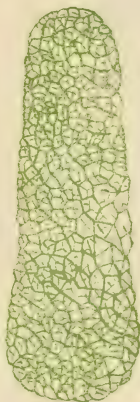
H. E. Forrest del.

Hydrodictyon.— A genus of Siphonaceae, (Conferoid Algae), containing one species, H. utriculatum, found in fresh-water pools in the Midland and Southern Counties of England. The frond consists of a green open network of filaments attaining a length of 4 to 6 inches when full grown (fig. 1) composed of a vast number of cylindrical tubes (cells) with rounded ends, adherent together at their extremities, the points of junction corresponding to the knots or intersections of the network. The organization of this plant, ^{and its development} has been the subject of very careful investigation by Al. Braun and others.

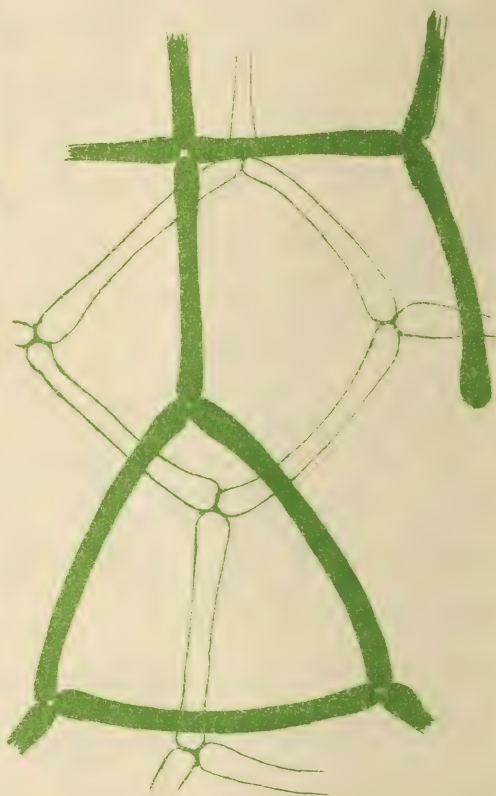
The rapidity of the growth of the Hydrodictyon net is wonderful; the component cells of the net increase, under favourable circumstances, to 600 times their original length in a few weeks. In cultivated specimens the whole history, from the origin of a net to the production of a new one, ^{passes over} in that or four weeks. {Description & two smaller figures from the Micrographical Dictionary which gives a long account of it.}

The specimens I am sending have made their appearance in my aquarium, I expect, from spores or buds accidentally brought from Kew Gardens with other gatherings. Wm. H. B.

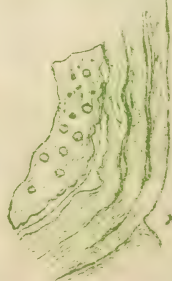
Hydrodictyon Utriculatum.



$\frac{1}{4}$ natural size



x 10 diameters



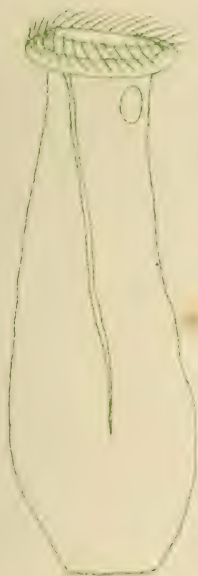
x 250

H E Forrest del.

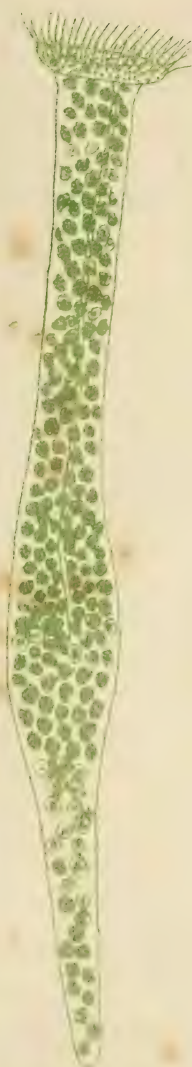


Whole colony.

Nat. size.



Free-swimming



Individual

Ophryotrocha carpathica

Ophrydium versatile — a genus of Infusoria of the family Vorticellidae. It consists of a colourless, gelatinous, rounded mass, either adherent or free, containing numerous greenish Vorticella-like animals imbedded and somewhat radiately arranged within it. Aquatic. Length of extended bodies $\frac{1}{100}$ of size of entire mass from that of a pea to that of the fist, and even more. The gelatinous mass or envelope has been described as consisting of separate portions or cells, and again as forming a homogeneous whole. It somewhat resembles and has been mistaken for frog's spawn. The bodies of the animals, when extended, are spindle-shaped, when contracted, oval or nearly spherical. They have a row or ring of cilia at the anterior margin of the peristome, also a lid with a fringe of cilia, as in Epistylis &c. The body exhibits annular constrictions and longitudinal folds, and contains scattered chlorophyll-granules, and a long, narrow, tortuous nucleus.

A distinct narrow elongated oesophagus is present. Ehrenberg remarks that at first the individual bodies are united in the centre by filaments, which subsequently disappear. The animals undergo the eurycting process.

When they leave the jelly, a posterior ring of cilia is formed, as in Vorticella, and the animals swim with the tail first.

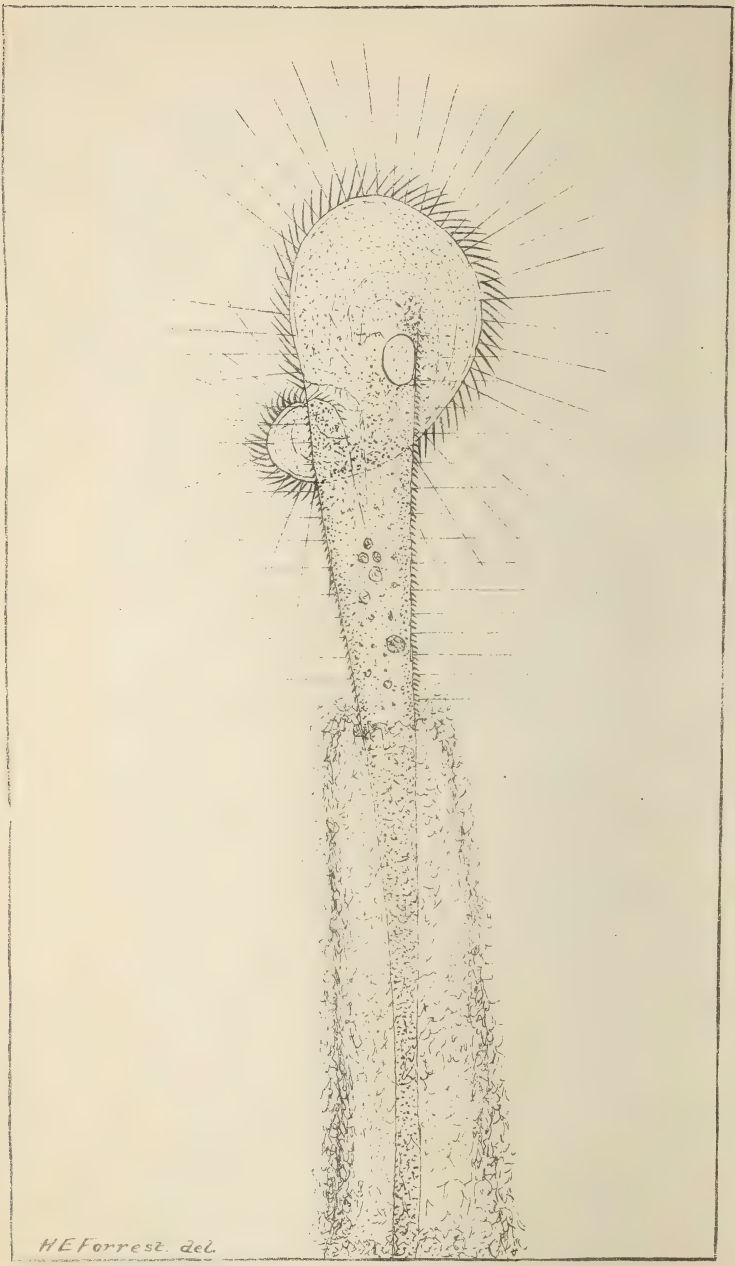
From the Micrographic Dictionary. I made another unsuccessful search after the Septodora in another locality in which it had been reported to have been found. I was however rewarded by finding the *O. versatile* which I had never seen before, although I believe it is not uncommon in some districts.

The *Ophrydium* which I have often found in the Hyde Park and named by W. W. Saville Bent a *O. longipes*, as well as the *O. versatile sessilis* found in this neighbour hood } are distinguished from the *O. versatile* by the absence of Chlorophyll granules, nor do they attain so large a size.

Thos Bolton, 17 Ann St Birmingham

Nov. 14/79

I received to-day from Mr Bolton some most interesting specimens from the Botanical Gardens. The weed is covered with a great variety of objects, including *Vorticella rubilifera* and *campanulata*, *Carchesium polypinum*, *Spectabile*, *Phileidin megalotrocha* (No. 3), and other rotifers as *Limnias*, *Crotaphylli*, *Stephanoceros*, and last but not least a very curious animal, Stentor Barretti of which a drawing is here given. It was discovered by Dr Chas A Barrett in 1877 in the Thames at Moulford and described by him under the name of *Stentor Barretti* in the Monthly Microscopist for April 1878. Subsequently it was found by Mr Serick at Bawt Green Reservoir near Birmingham and described by him in the Midland Naturalist for Nov 1879. It has now been found by Mr Bolton on the roots of plants in the water in a hot house. This animal is $\frac{1}{8}$ inch long and inhabits a tube dirty brown case of a gelatinous consistency, in old specimens rendered quite opaque by particles thrown down on it by the action of the cilia. The ciliary wreath is erect and shaped like the human ear, but viewed sideways it resembles an ear of corn. The edge of the disk and the body wall is studded with very long bristles of extreme tenuity, and requiring a good $\frac{1}{2}$ inch square and oblique illumination to show them distinctly. A large contractile vesicle is situated behind the disk. Just in front of this is the mouth leading into a short gullet lined with cilia. Mr Serick writes that he thought he detected a moniliform nucleus. Mr Barrett repeats several times that there are no cilia present on the body as we find in the other *Stentors*, and appears therefore to be certain some doubts as to the propriety of placing it in that genus, but I have been able to demonstrate their existence very clearly as represented in my drawing. Not wishing to give merely my own testimony against his, I showed it to two friends who both saw the cilia distinctly. The cilia here are, as in the other *Stentors*, much smaller than those on the disk and are intermittent in their action, frequently standing out stiffly like velvet, but when they work they always work towards the base, and it is no doubt by their means that the particles are guided into their places which build up the tube. As for the last Besides the organisms above enumerated I have seen on portions of these root fibres some *Stentor Huxleyi* and a curious acinetid which I believe is not common. Thos Bolton 17 Ann S. Birmingham Dec 12 1879



H E Forrest. del.

Stentor Barretti.

ON CARCHESIUM SPECTABILE.

BY H. E. FORREST.

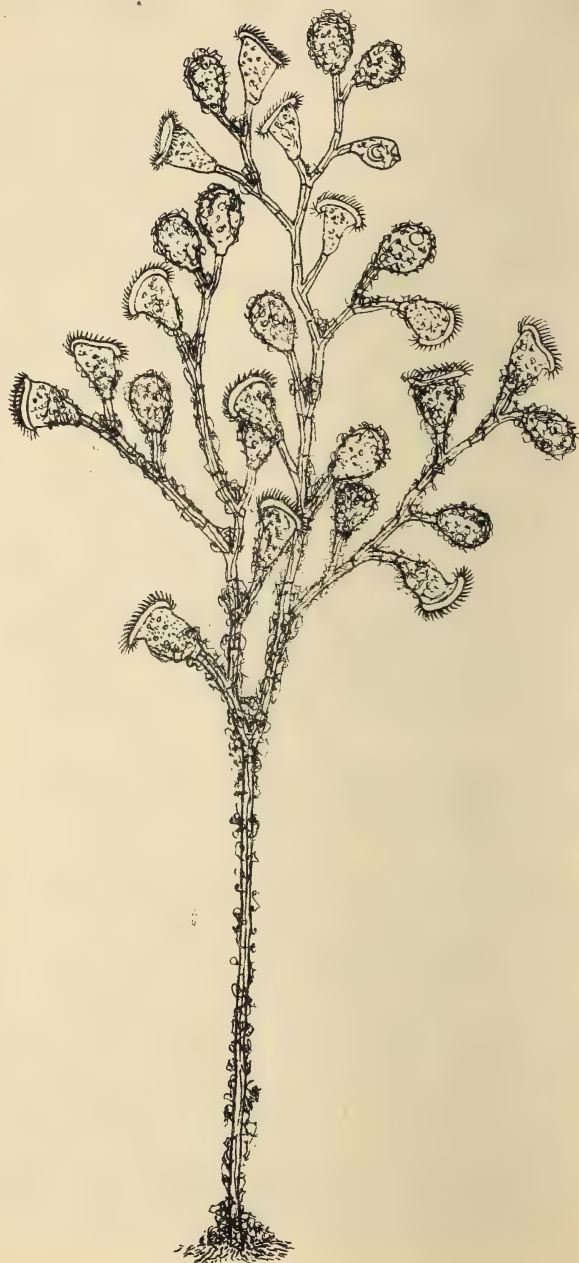
[Reprinted from the "Midland Naturalist" for August, 1879.]

Among the numerous, rare, and beautiful forms of animal life which were obtained from the Barnt Green Reservoir in such abundance last Autumn, by members of the Birmingham Natural History and Microscopical Society, was a species of *Carchesium*. I had the pleasure of spending several evenings with Mr. J. Levick in examining these rich gatherings, and both he and I noticed the wide difference between this and the common *Carchesium polypinum*, which also occurred in the same water. Since then I have received through Mr. Bolton a gathering of the same, made by Mr. Thompson, the secretary of the Microscopical Society of Liverpool. Mr. Bolton tells me he has also found it at the Hyde, near Stourbridge, and at the end of June, 1879, I found it again in the river Avon, at Evesham.

As *C. polypinum* was the only species of the genus with which I was acquainted, I thought, at first, that this was a new species; but as my knowledge of the literature of the subject was insufficient, I forwarded specimens to Mr. W. Saville Kent, of London, asking him if there was any described species which agreed with it. With great courtesy he sent me descriptions of no less than four species other than *C. polypinum*, and expressed his opinion that the one in question was *Carchesium spectabile*, an opinion which upon mature consideration I fully endorse. Mr. Kent writes that there is no good published figure, and that Ehrenberg's scanty and somewhat vague description seems to be all that is known of it. It is as follows: "Bodies conical-campanulate, dilated anteriorly; polypary two lines in height, forming an obliquely conical bush of considerable size."

This description is perfectly correct, but very meagre, and the following additional particulars will probably be found useful, as I feel sure that when once public attention has been called to it, it will prove to be quite a common species.

Carchesium spectabile grows in little tufts attached to weeds or roots in stagnant or slowly running water. The colonies are in the shape of a solid cone, while *C. polypinum* grows as a hollow cone. The bells are placed thickly together on the stalks, and when the cilia are in motion the rim is everted and dilated beyond the bell, but not so much as in *C. polypinum*. It is very sluggish in its habits, and its sensibility to irritation is so slight that in order to make it contract its pedicel it is necessary to tickle it with a bristle. This peculiarity may easily cause it to be mistaken for an *Epistylis*. It has a curious habit of investing itself all over with minute particles obtained from the surrounding water, and is often so entirely buried in this dirt as to be almost invisible. The cleanest specimens I have seen were those from the river Avon, but even there they exhibited this tendency, though in a minor degree. Students of Infusoria are anxiously awaiting the issue of Mr. W. Saville Kent's work, in which this and the other known species will be well and amply figured.



Carchesium spectabile x300

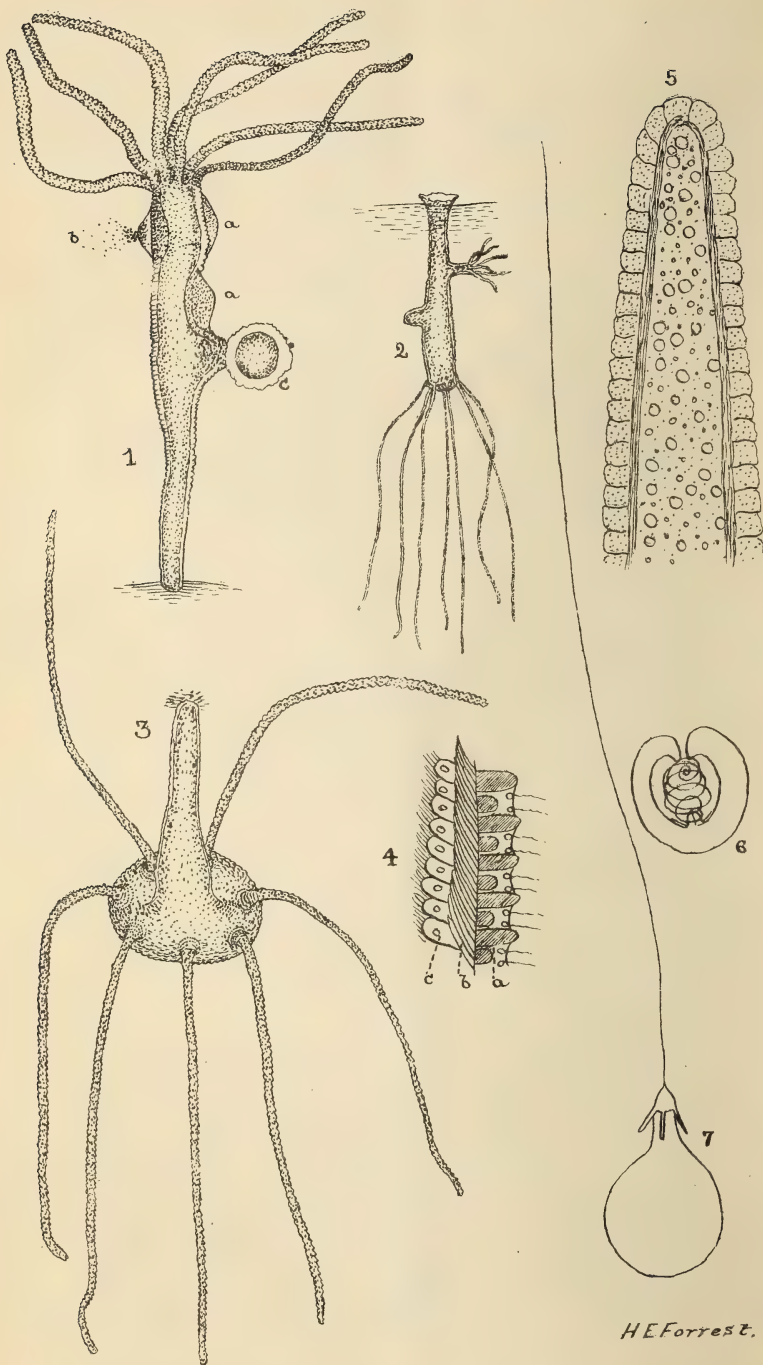
H.E. Forrest. del.

THE FRESH-WATER HYDRA.

BY H. E. FORREST.

The Fresh-water Hydra, although one of the commonest inhabitants of our ponds and ditches, is yet of absorbing interest to every true and earnest biologist. The interest which he takes in it does not spring from a biological basis only, it also partakes largely of the historical. This little animal, one of the first fruits of microscopical research, has been studied by a truly immense number of eminent men, and has, probably, had more volumes, pamphlets, and papers written about it than any other animal in existence. Leeuwenhoek, Trembley, Ehrenberg, Corda, Schaeffer, Johnston, Hancock, Allman, and many other honoured names swell the role of the contributors to "hydra" literature in past times, while in the present day almost every dabbler in natural science writes some "note," or "paper," or "anecdote" about it. In the face of all this it is lamentable to find that of all the multitude of English text books of zoology, *not one* contains really good and correct figures of the animal. It is hoped that the drawings on the other side will be found useful, as they have been carefully prepared and are, as far as possible, correct.

Fig. 1 represents *Hydra vulgaris* showing the reproductive organs, *aa* are the sperm sacs, or testes, and at *b* one of them is seen emitting the spermatozoa which swarm out into the water, and some of them must almost inevitably reach the ovum (*c*) and fertilize it. After fertilization the ovum becomes covered with a thick hard rough envelope, and drops into the mud, where it remains until the following spring. I think that most of the Hydræ die towards the end of the winter, (February,) although I have taken them from beneath the ice in December, in considerable numbers. The ova, however, snugly tucked away in the mud, are uninjured by the cold, and with the first warm weather, hatch, each giving rise to one individual. These again, by the familiar process of gemmation or budding, (Fig. 2,) rapidly increase in numbers, until the water literally teems with them. I have found them, indeed, matted together in solid masses, of several square inches extent. Fig. 2 represents a hydra floating. This it does by elevating its base above water until it becomes quite dry, when, letting go its hold of everything, it remains freely suspended in the water. Fig. 3 is very curious. I have on two occasions seen a hydra in this position. While still attached by its base, the animal looped itself over and seized hold of the glass with its mouth. The edges of the latter began to stretch, and continued doing so until it was converted into a vast sucker, the tentacles standing up round the edge, and the body, like a handle, projecting from its centre. This is interesting, as showing the enormous dilatibility of the mouth. Fig. 4 is an *ideal* section of the body wall, to show the alternate large and small cells, which give that "pimply" appearance to the ectoderm (*a*.) the muscular elongated cells in the middle, called mesoderm (*b*.) and the ciliated inner cells, the endoderm (*c*.) In the furrows between the larger cells of the ectoderm (*a*) are situated the remarkable organs called thread-cells, one of which is represented very highly magnified at Fig. 6, in a state of rest, and at Fig. 7, with the thread ejected. If a small Hydra be taken and flattened out between two pieces of glass, and then examined under a high power, the action of the ciliated endodermal cells will be seen in the tentacles. In the clear space between the walls of the tentacle (Fig. 5) there are a number of particles of food floating in the protoplasmic fluid. These are in constant motion, rushing about in all directions. Although the cilia are invisible, the movement is obviously due to the ciliated endodermal cells before mentioned. This must not be mistaken, however, for another somewhat similar movement of the protoplasm, due to a perfectly different cause, I refer to the kind of peristaltic movement observed whenever the tentacles expand or contract; thus:—when the tentacle narrows and elongates, the contained fluid rushes upwards; when it shortens and widens the fluid runs back again. Elongation of the tentacles is the result of narrowing; it is produced by numerous muscles encircling it, and from the fact that they *do* contract, we must presume the existence of longitudinal muscles too.



H E Forrest, del.

HYDRA VULGARIS

LEPTODORA HYALINA.

2

BY WALTER GRAHAM, F.R.M.S., PRESIDENT OF THE BIRMINGHAM
NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

Reprinted from the "Midland Naturalist" for September, 1879.

About three weeks ago a few members of the Birmingham Natural History and Microscopical Society visited a pool in the neighbourhood of Olton, which, being private property, is not often examined. Four of the party proceeded in a boat to endeavour to ascertain what treasures the water contained. The first dip caused no small excitement. A bottle of water, apparently containing diluted pea soup, was eagerly examined by one after another, for among the masses of a minute alga (*Clathrocystis aeruginosa*) were swimming sundry apparently animated chips of thin glass. What was this translucent creature? was the question. The glass larva was speedily dismissed, but even the class to which the unknown capture belonged was doubtful, the best guess hazarded being that it was a larval form of some Entomostracan. Specimens were carefully secured for examination under higher magnifying power than pocket lenses afforded, and this examination revealed the fact that the mysterious stranger was no larval form, but a fully-developed Entomostracan, both eggs and young being detected beneath the carapaces of some specimens. But still its name was wanting. "Baird," and the "Micrographical," and "Pritchard" failed us, but Professor Ray Lankester came to our aid, for, on having specimens submitted to him, he pronounced it to be *Leptodora hyalina*, a species new to Great Britain, though found in Sweden and Germany. Curiously enough the same "dips" which gave us *Leptodora* gave us also another new British species, which is described at page 217.

In the hope that other students of this class may meet with *Leptodora*, the following imperfect description is given, which, with the help of the accompanying plate, (Plate V.,) drawn by my friend, Mr. H. E. Forrest, may enable them to identify the crystalline stranger. *Leptodora* belongs to Baird's Legion Branchiopoda, Order II., Cladocera, Family I., Daphniadæ. The head is elongated, not beaked. Superior antennæ long, and studded with setæ. The inferior (or propulsive) antennæ are large and very powerful, producing a motion similar to that of a man swimming. The first joint occupies fully half the length of the antenna. From it two equal branches proceed, which are four-jointed, and are studded with setæ, while the first joint is smooth. On each side of the head, immediately under the eye, is a small organ covered with cilia. The feet are ten in number, close together, and setaceous.

The carapace is extremely hyaline, divided into seven segments; the tail is produced into two curved extensions resembling that of an earwig, excepting that in *Leptodora* these extensions are furnished with long, slender setæ. The body is long and narrow, and so translucent that the internal organs can be clearly seen. A large contractile organ is situated immediately behind the eye, connected by two nerves (muscles?) with the muscular centre between the inferior antennæ. A pulsating vessel occupies the first segment behind the antennæ. A long straight tube or intestine passes from the first or head segment to the last segment but one, where it enters a wide cæcal vessel, somewhat convoluted or corrugated, which terminates at the bifurcation of the tail. Both male and female specimens were secured, the female differing in having a larger carapace, extending over the first and second segments of the body behind the inferior antennæ, under which carapace the ova and young are retained until the latter are sufficiently developed to leave the parent. The young resemble the parent, but are thicker in proportion to their length, and the antennæ are shorter than in the adult.

The specimens taken (adult) varied from $\frac{1}{4}$ in. to nearly $\frac{3}{4}$ in. in length by about $\frac{3}{8}$ in. across the body, immediately in front of the inferior antennæ.

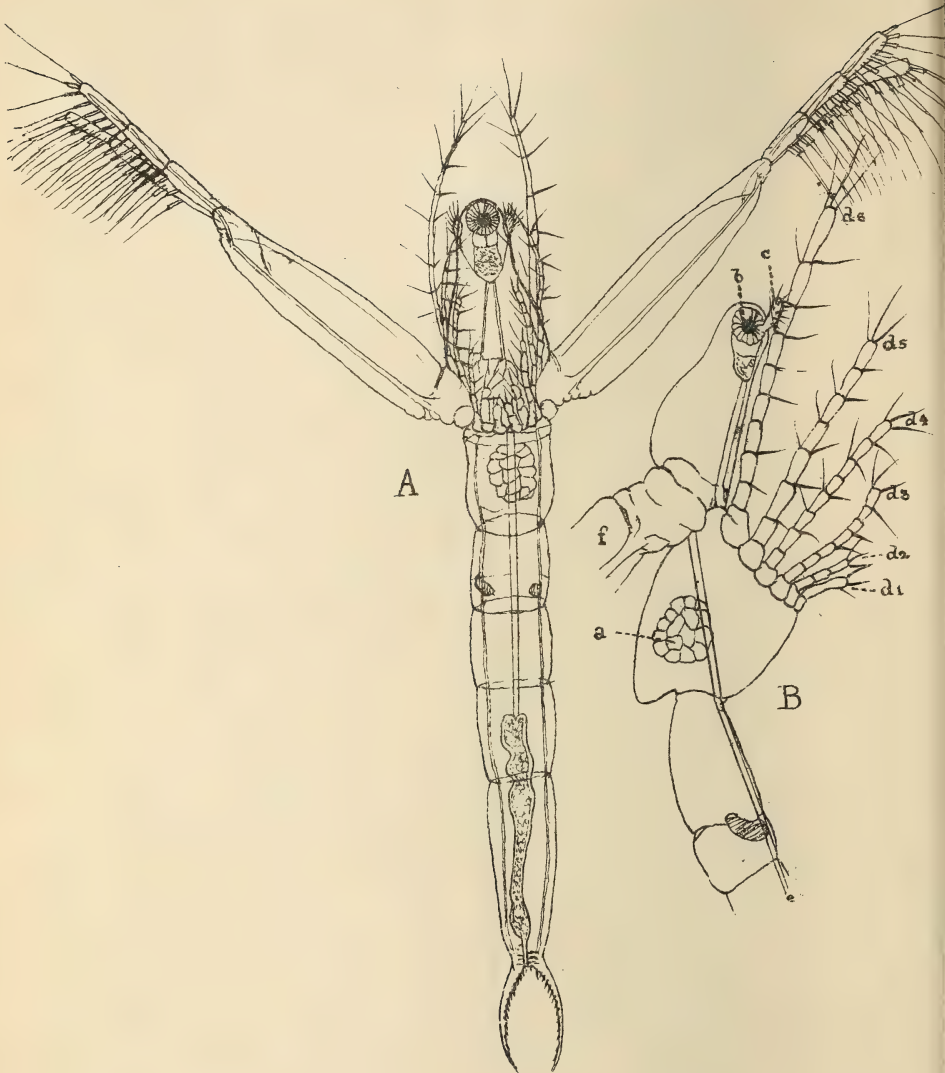
Sir John Lubbock has called attention to the capture of this species in some remarks made before the Biological Section of the British Association at Sheffield.

REFERENCES TO PLATE V.

Fig. A.—*Leptodora hyalina*, $\times 50$ diameters.

Fig. B.—Ditto, $\times 60$ diameters. a, Pulsating vessel; b, Eye; c, Origin of bearing tail; d 1 to 5, Feet; d 6, Superior antennæ; e, Tube or intestine; f, Inferior antennæ.

Plate V.



H. E. Forrest, del.

Leptodora hyalina.

Fig. A $\times 50$ diameters.

Fig. B, side view of Thorax and part of Abdomen $\times 60$ diameters.

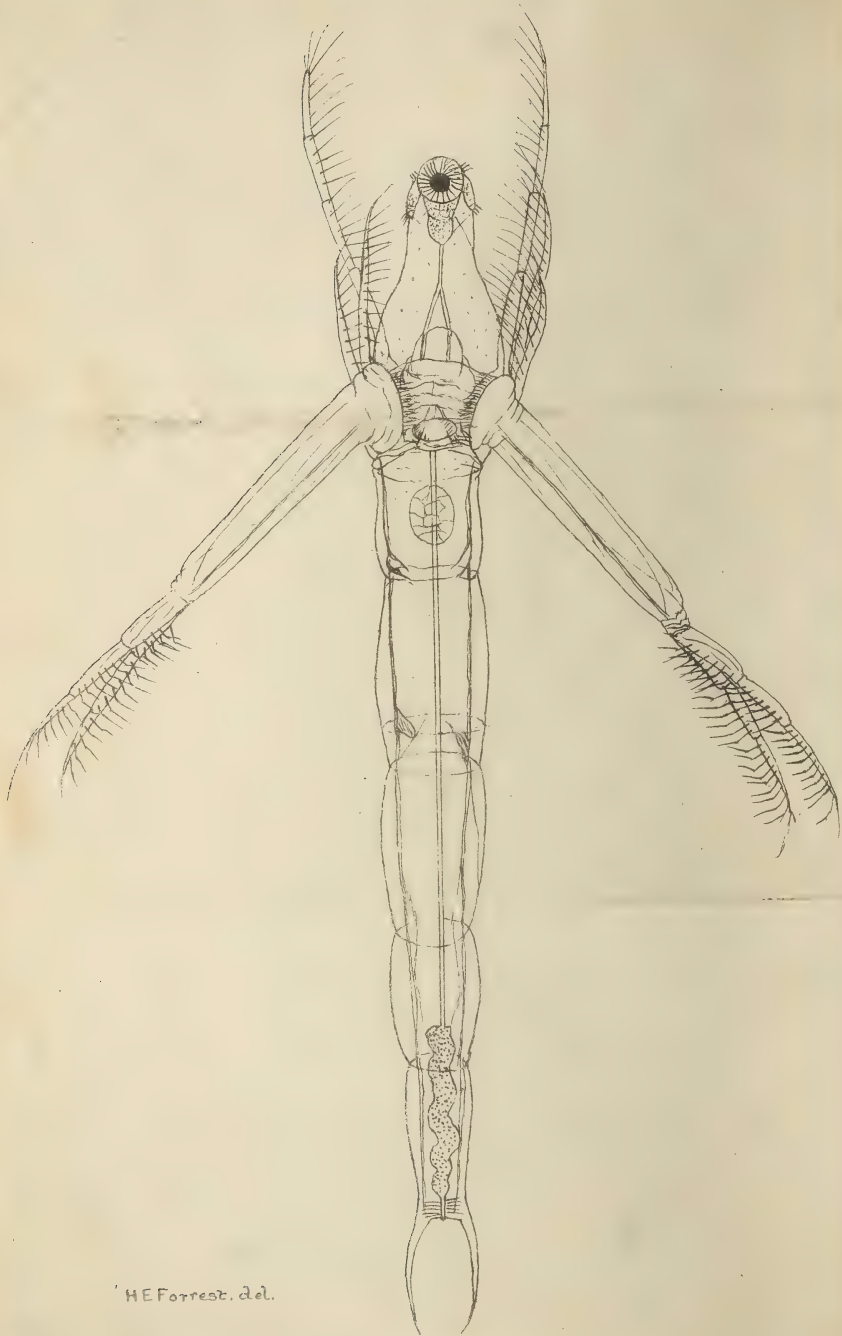
= Lepidostoma

2

I enclose some specimens of a wonderfully transparent animal which I take to be a larval form of one of the Entomostriaca, but so far I have failed to identify it.

It is about $\frac{1}{5}$ ^m of an inch in length, swims actively in the water with a jerking motion by means of a pair of very long oar-like antennae. It carries a single glistening compound eye at the extremity of a prominent proboscis, which also contains, behind the eye, a large brain-like ganglia, and from this a pair of nerves branch to the insertion on the proboscis of some small antennae just behind the eye. The main nerve proceeds backwards from this large ganglia dividing into two branches near the base of the proboscis where they end in other ganglia just above the mouth and joints of the pair of large oar-like antennae. The large mouth is armed with a formidable pair of tooth-like mandibles and there are six pairs of legs, all closely crowded together. The remainder of the body is apparently divided into five segments, the first of which is a highly contractile heart or dorsal vessel. The floated particles in the blood may be seen coursing over the surface of the body, limbs and proboscis in all directions. A very narrow alimentary canal passes down the centre of the body opening in the course of the 4th segment into a larger caecal vessel. It is interesting to watch the active peristaltic movements in both these vessels and is suggestive of the wonderful minute adaptation of muscles and nerves ^{which} must exist to produce this rhythmic motion. Since writing the above I have found a specimen apparently carrying four large round eggs in the 2nd segment of the body, which would lead to the supposition that it is no larva, but a mature animal.

The Bolton Spinal B. Birmingham Nov 1799



ON A NEW ENTOMOSTRACON.

2

BY H. E. FORREST.

Reprinted from the "Midland Naturalist" for September, 1879.

A short time ago Mr. Thomas Bolton sent me some water from Olton Reservoir, containing, amongst other things, a curious Entomostrakon, which he wished me to examine and draw. At the first glance I saw that it was a form new to me, and forthwith set about drawing it. That done, the next thing was to find out its name, but vainly did I search through and through Baird's "Entomostraca"—it was not there. All that could be discovered about it was that it belonged to the Entomostraca, order Cladocera, family Daphniadæ, and genus Daphnia. Baird describes seven species, viz., *Pulex*, *Psittucea*, *Vetula*, *Schæfferi*, *Reticulata*, *Rotunda*, and *Mucronata*, but the one in question was none of these, and I have therefore the pleasure of describing it as a new species, unless it has already been described in some other work unknown to me. Every Naturalist, and especially every student of Entomostraca, will feel that it is but a just and graceful tribute to the name of one who did so much good work for science at a time when very little was known of these little creatures, if this new species be dedicated to Dr. W. Baird, the author of "The Natural History of the British Entomostraca," especially as no other animal is so named. I therefore christen it *Daphnia Bairdii*, if it has not yet received any other name.*

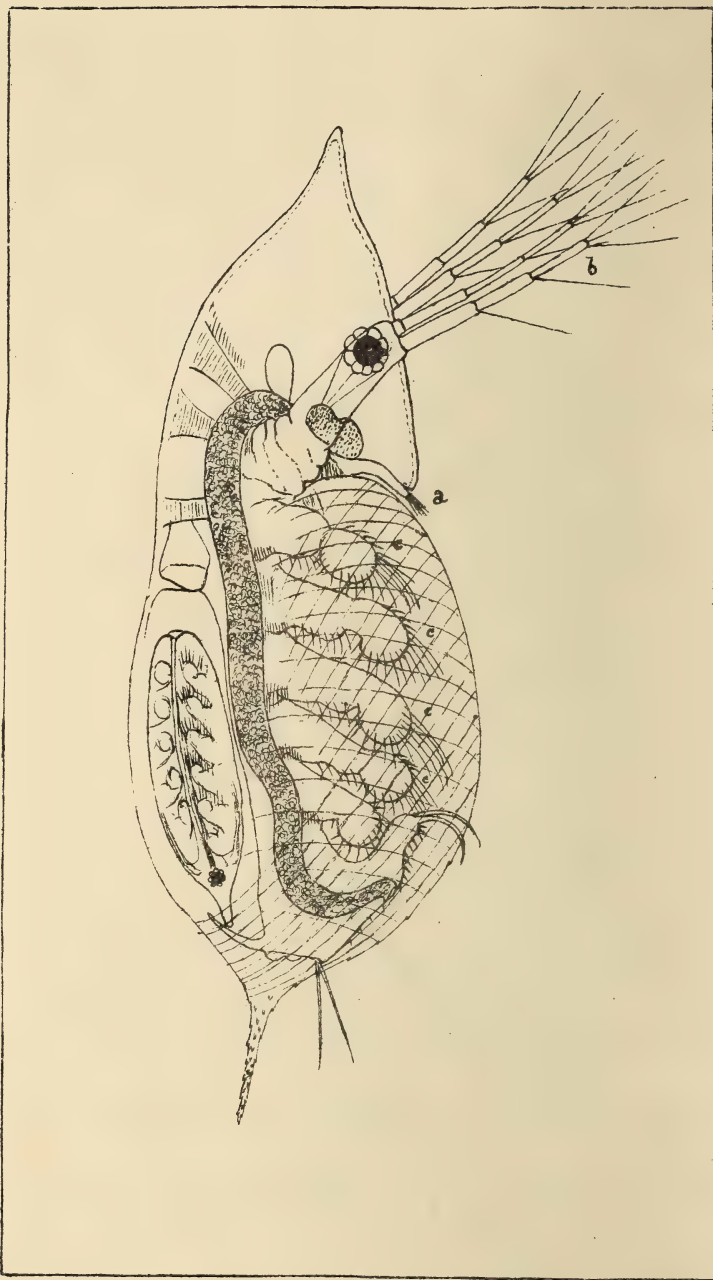
The appearance of *Daphnia Bairdii* in the microscope is irresistibly comic. It has an immense head which terminates upwards in a sharp point, exactly as if it were wearing a "dunce's cap," and in this its one goggle eye rolls about with an air of supernatural wisdom. Its body is transparent and almost colourless. It has the following characters in common with the seven other members of the same genus:—Head produced downwards into a prominent beak, from the base of which spring the two very small, one-jointed, superior antennæ (a). The inferior antennæ (b) are large and powerful, two-branched, one branch three-jointed and bearing five setæ, the other branch four-jointed and bearing four setæ. It has five pairs of feet (c) all enclosed within the carapace. The following characters distinguish it from its congeners:—The valves of the carapace or shell are oval, transparent, nearly colourless, and the surface is marked with striæ crossing each other obliquely. These markings are not nearly so apparent as in the other Daphniæ. The head is very large (larger than in any other species) and almost an equilateral triangle. The lower extremity of the valves terminates in a long, sharp spine, which is finely serrated; the edges of the valves, too, are sparsely serrated to about half-way up. Length from top of head to extremity of spine, 1-20in. The individual drawn on Plate IV. is an adult female, and has within her carapace and behind her body a young one, almost ready to issue forth. This young one is seen edgewise, and it will be noticed that the triangular head is not rounded but flattened at the sides, like an admiral's cocked hat. In young specimens the body is more rotund than in the adult, and the top of the head is not nearly so sharply pointed. *Daphnia Bairdii* does not appear to be very prolific, as I never saw more than two eggs in one female. The male I have not yet seen, though I have searched for it, and hope to obtain it eventually. Anyone desirous of seeing living specimens of this interesting animal can obtain them from Mr. T. Bolton, 17, Ann Street, Birmingham.

* Professor E. Ray Lankester has since identified this Entomostrakon as the *Hyalodaphnia Kahlbergensis* of Schödler, and new to Great Britain.

THOS. BOLTON, 17, ANN STREET, BIRMINGHAM.

Orders received for the "Midland Naturalist," published monthly,
post free 6½d., or 6s. per annum.

Plate IV.



H. E. Forrest, del.

Daphnia Bairdii.

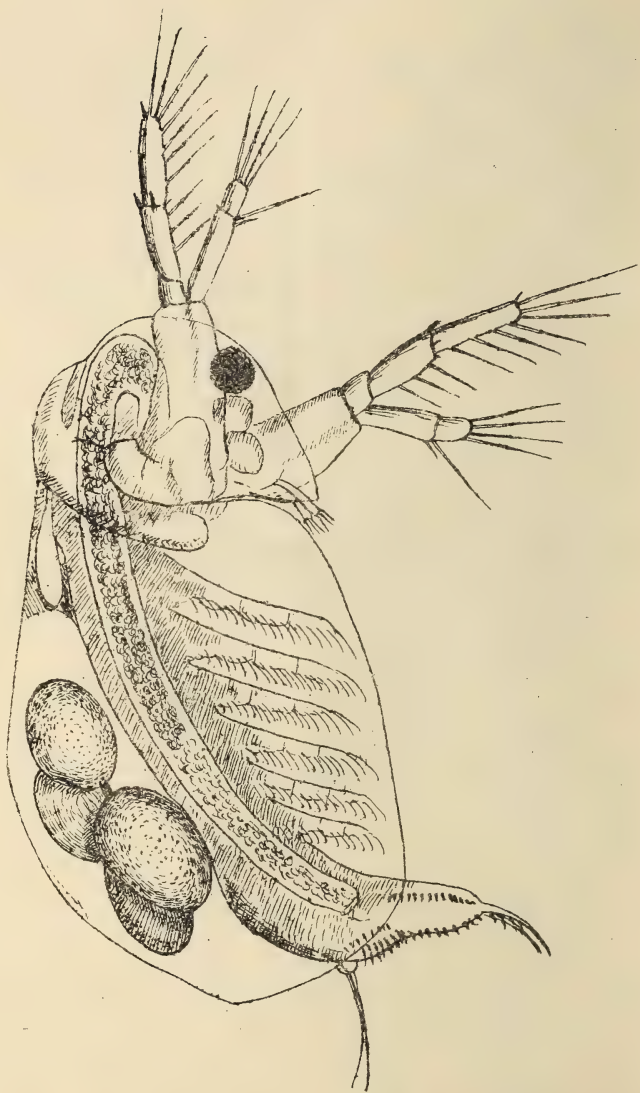
Sida crystallina

2

A large species of Entomostraca of the family Daphniada and order Cladocera. The motion of the *Sida* through the water is a sort of rapid running movement. They are generally inactive, and adhere in a peculiar manner by the back of their heads to the side of the vessel in which they are contained, remaining there for hours. They adhere most probably in the same way to the weeds in the water where they are found, as it is by skimming the stems of the weeds, that they are detached and caught. They do not appear to be numerous in the localities in which I have found them, and indeed are of rare occurrence."

From Baird's British Entomostraca. I am surprised at Baird's remark as to the rare occurrence of this species, having myself generally found it present in large pools. I shall be glad to hear whether my correspondents have often seen it before.

I am glad to inform my correspondents that the new Entomostraca *Leptodora* and *Glyptodaphnia* have been found in another locality in this neighbourhood. The Bolton, 17 am S. Birmingham. Sep 12 1879



H. E. Forrest. del.

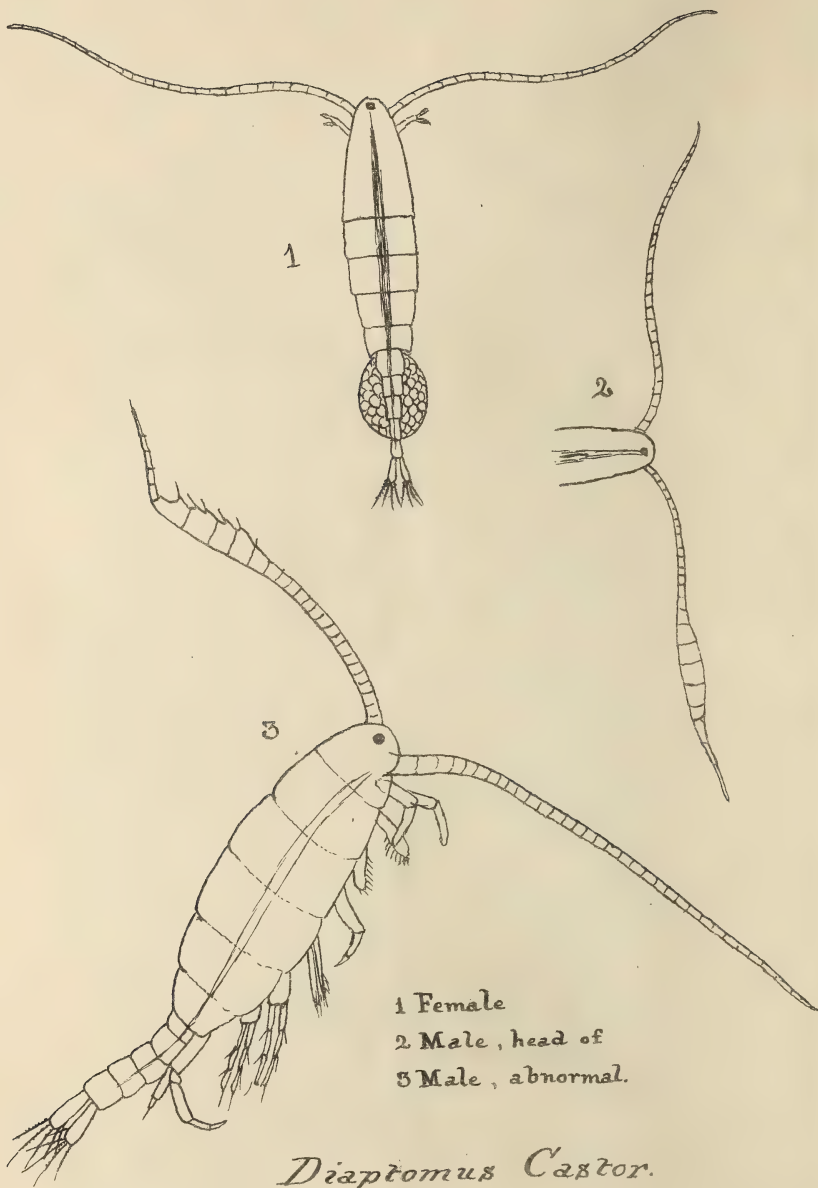
Sida crystallina.

The head of the Diaptomus Castor may be easily distinguished from the body, though it is firmly articulated with the first segment of the thorax. The thorax consists of five rings, the first being considerably the largest. The abdomen is composed of five articulations also, the last being divided at its extremity into two lobes, each of which gives origin to five plumose setae. The eye is large, of a fine ruby colour; and we can distinctly see the muscles which move it, and of which there are several. The antennae are large organs, of great length, and strong. They are formed of about 26 articulations, each furnished with one or more setae, the last terminated by five of different lengths. In the male, the right antenna alone has the swelling and hinge-joint, which characterise the sex. This joint is formed in the same manner as that in the Cyclopidæ. (Baird's Entomostracæ)

I am glad to inform my correspondents that I have lately found the male of the Septodonta hyalina, and hope to obtain a tolerably abundant supply for the present. It has apparently nearly disappeared from the first habitat in which it was found, but has since been taken in three other localities in the Midlands. Since Sir John Lubbock described it before the British Association at Sheffield, it has attracted considerable attention. If treated with Osmic Acid it makes a most beautiful mounted object. The details of its nervous, and muscular systems and general anatomy are differentiated by the action of the acid, and open up a wonderful field for study to the Naturalist.

Ed. Ballou, 17 Ann St. Birmingham

Oct' 10 1879



1 Female
 2 Male, head of
 3 Male, abnormal.

Diaptomus Castor.

H E Forrest del.

CRISTATELLA MUCEDO.



A more interesting and beautiful Animal than a fully developed specimen of *Cristatella mucedo* can scarcely be imagined. The entire colony is of an oval shape, convex above and flat below, where it attaches itself to neighbouring objects. Upon the convex surface are arranged the orifices through which the polypides emerge, they are placed near the margin, and run round the entire cœnœcium in three regular concentric series, which alternate with one another, and leave an oval space in the centre where no orifices exist.

In the middle of the flattened under surface is an oval disc, resembling the foot of a gasteropodous mollusk. On this disc, which is contractile, and admits of frequent change of shape, the colony adheres to neighbouring objects, or creeps about on the submerged leaves and stems of aquatic plants. From the edges of the disc a flat space extends outwards, passing beyond the external series of orifices in the form of a projecting margin, whose interior is occupied by a series of tubular cells or chambers, visible through the translucent skin, and extending in a radiating direction from the disc outwards, but possessing no external opening.

The statoblasts are very characteristic. They are about 1-35th of an inch in diameter, exclusive of the marginal spines, and, with the exception of the statoblasts of *Pectinatella*, which they closely resemble, are larger than those of any other Fresh-water Polyzoon. They are also, with the same exception, the only ones having an orbicular shape. One face is a little more convex than the other. The annulus is wide, very distinctly cellular, and of a light yellow colour. The disc is deep reddish-brown, and elegantly mamillated. The spines spring from both faces of the disc, just within the annulus, and thence radiate outward, extending for some distance beyond the margin. The spines springing from the more convex face are somewhat longer and more numerous than the others, and alternate with them. All the spines are terminated by two, three, or four curved hooks resembling grappling irons. Towards the end of summer, the statoblasts occur in considerable numbers in the interior of full-grown specimens, and are visible through the transparent tissues of the animal. On the death or decay of the cœnœcium they are liberated, when they become attached, by means of their hooked spines, to various aquatic plants, and ultimately open for the escape of the young, by the separation of the two faces, at the commencement of the following summer. The young, on its escape from the statoblast, is at first solitary, but is rapidly multiplied by the production of gemmæ.

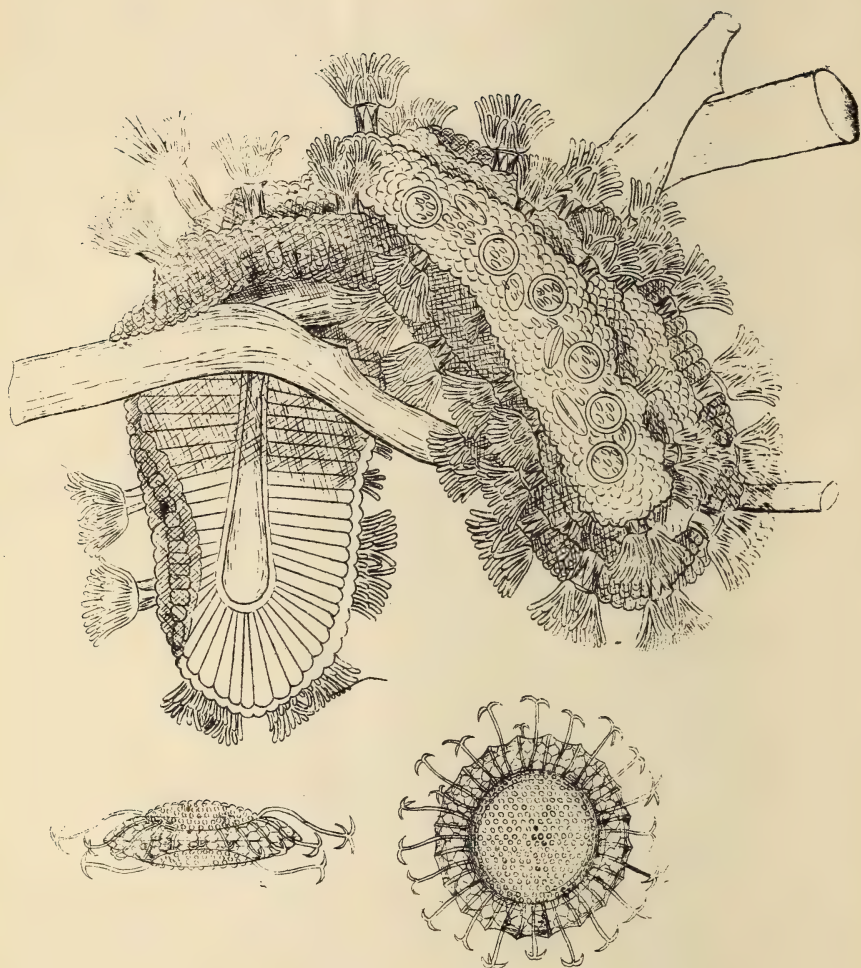
Fresh-water Polyzoa, by Prof. G. J. Allman.



LIVING SPECIMEN IN TUBE, POST FREE, TWO SHILLINGS.

Mounted Specimen of Statoblast, Post Free, 1s. 8d.

THOMAS BOLTON, 17, Ann Street, Birmingham.



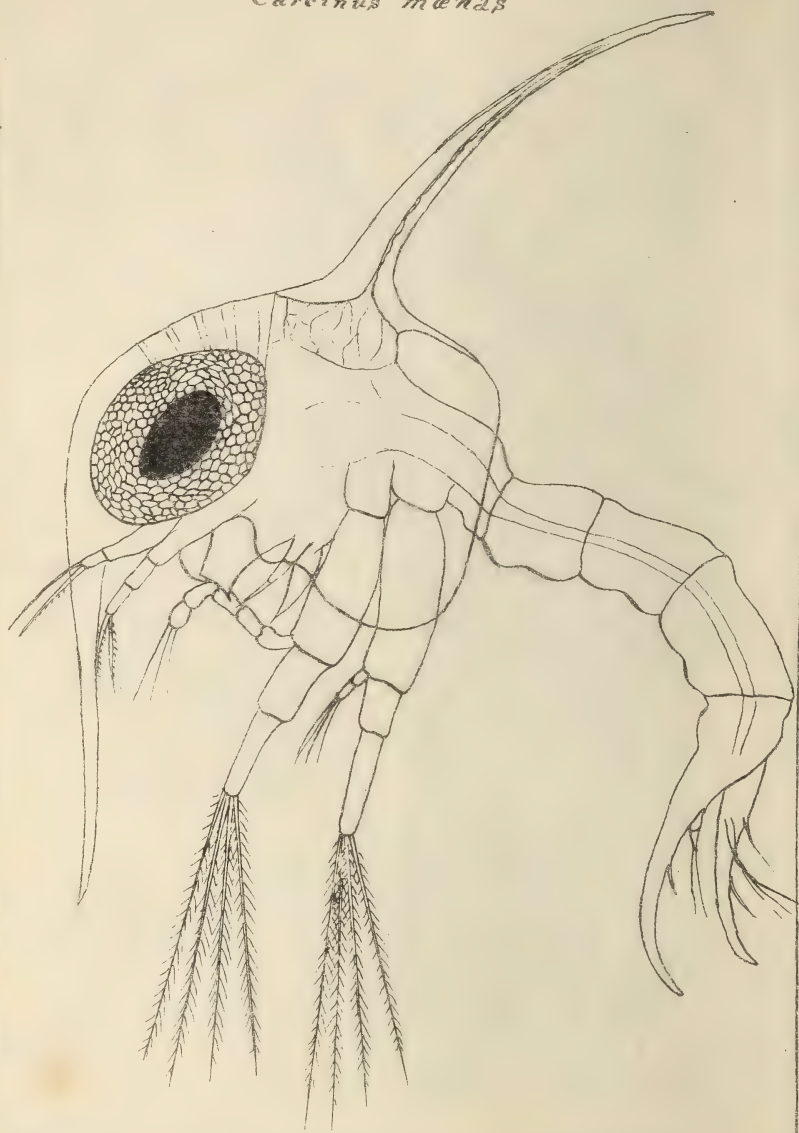
The Zoëa is that of the common shore-crab, Carcinus maenas, and represents the youngest stage of the animal. When first hatched out from the eggs, these little creatures are enveloped with a membranous covering, but after a few hours they burst through it and appear as represented in the sketch. Even when they are covered up with the tunic, which fits over the limbs and is not merely a loose bag, they are able to swim about; the prolegs on the back is however bent down and contained within the general sac as is also the long beak.

Mr. Vaughan Thompson was the first observer who noticed that crabs passed through certain transformations before assuming the adult form, and his statements met with much opposition. Spence Bate however in 1857, confirmed the observations of Thompson made some years previously, and placed the question out of doubt by describing the various stages in the development of the Zoëa, which is accomplished in a series of moults, and a gradual development of the limbs. H.W.J.

Thompson, Bolton 17 Ann St Birmingham, Jan 7 1880

Larva (Zoëa) of Crab.

Carcinus menas



H. E. Forrest. del.

I am glad this week to send to my subscribers specimens of the charming fresh-water Polyzoon Lophopus crystallinus. This under the $\frac{1}{2}$ in objective, and good dark-field illumination is, I think, one of the most pleasing objects that Pond Life amongst its many treasures offers to the Microscopist especially if a trace of Carmine be added to the water. It is a fine sight to see the closely packed bundle of tentacles gradually extruded from the previously wrinkled and collapsed orifice in the hyaline sacciform cœcicum; then to see them gradually separate and expand shewing the wonderful double crescent or horse-shoe shaped lophophore fringed with its double row of long flexible tentacles. The lower parts of the tentacles for about a third of their length are joined together by a transparent and thin hyaline extension of the Lophophore called the Calyx. Each tentacle is fringed on each side with a line of cilia which are in continuous rythmical vibration shewing an apparent rapid motion up one side, and down the other, and producing an active vortex carrying an abundant supply of all floating matter towards the mouth situated in the centre between the outer and inner crescents of tentacles, and covered by a highly sensitive tongue-shaped lid or Epistome. The tentacles are often in active motion pushing things towards the mouth at other times arching outwards over the Calyx to allow the objects not to its taste to float out. Professor Cellman's original drawings in his Monograph of the Fresh-water Polyzoa (from which W. Forrest has made this sketch) is wonderfully life like, and I would advise any of my correspondents that have the opportunity, to compare the living object with his drawing and description.

Thos. Bolton, 17 am St Birmingham Dec 19 1879



Leptopus Cryptanthus

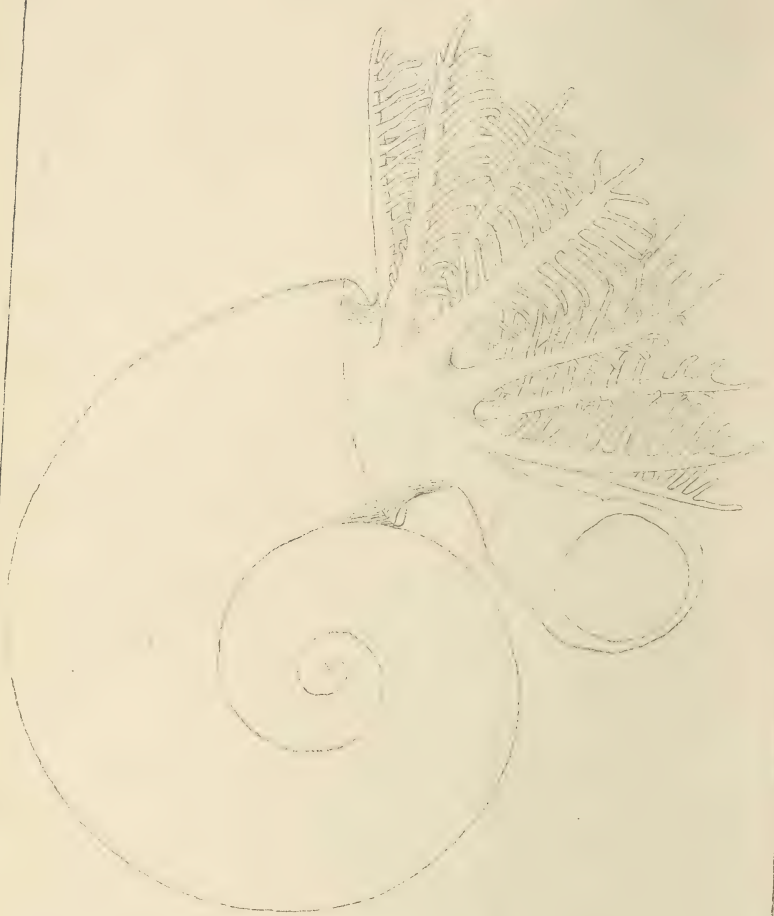
Spiroëbis nautiloides

This pretty little marine worm secretes a, ^{spiral} nautilus-shaped shell very commonly encrusting sea weeds, and also the shells of the crustacea. They are very hardy and can be kept for a long time in sea water, and very persistently protrude their circle of branchiae when under examination under the microscope.

D. Johnston in his catalogue of British Worms describes this species amongst the Serpulidae Genus *Spiroëbis*. Basal leaves of the branchiae rolled in circle or semicircle; one or two opercula not united together when two, tubes generally not entirely attached, burrowed into a flat or nearly flat mass. Species *S. nautiloides*. Operculum rarely shield-shaped parabolical; branchial filament 8/10 divided, 3 on each side; tube opaque, wrinkled with striae, convex above, flat beneath, last turn not hooked.

Professor Huxley says: "In some (*Serpulidae*) a tentacle is enlarged and its end secretes a shelly plate which serves as an operculum, and shuts down over the mouth of the calcareous tube inhabited by the animal, when it is retracted."

The Bolton 17 ann 8. Birmingham Jan 27 1879



Spirorbis nautiloides

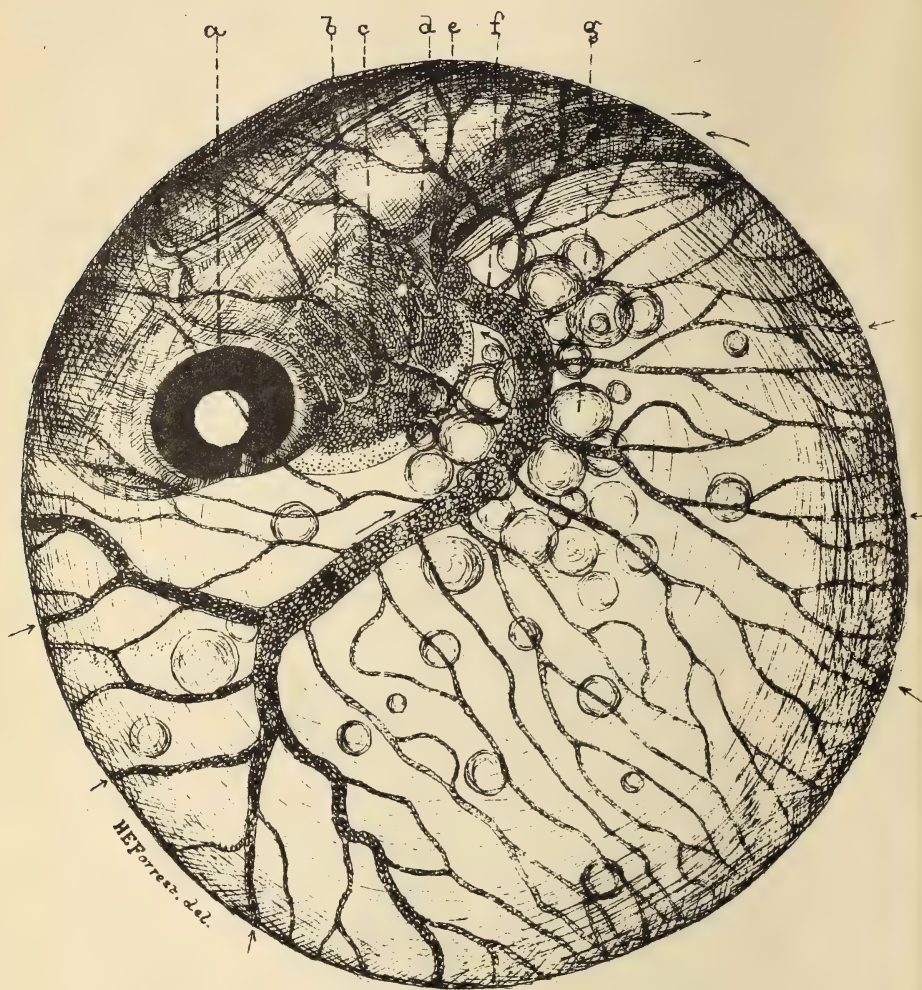
H. E. Forbes del.

This is a very interesting object for the microscope, requiring only a low power (2 or 3 inch) to shew it to perfection. The most conspicuous point in the egg is the eye (a) which is large and very advanced. The blood appears to be aerated by contact with the surrounding water in numerous fine capillaries which ramify in all directions just beneath the surface of the egg. The blood from all these capillaries is poured into one large vein (f) and enters the heart (c) from whence it is driven forward, part into a large artery just beneath the head of the embryo, whence it is distributed again into the capillaries on the opposite side of the egg, and part into the gills (b) passing through them into an artery (d) which supplies the body of the embryo with blood necessary to build up its structure. This goes right to the tail of the animal and returns along the vein (e) to the heart (c) where it mixes with the blood from (f).

W. C. Forrest

Thos Bolton
19 Ann Street

CIRCULATION IN EGG OF TROUT.



a. Eye

b. Gills

c. Heart

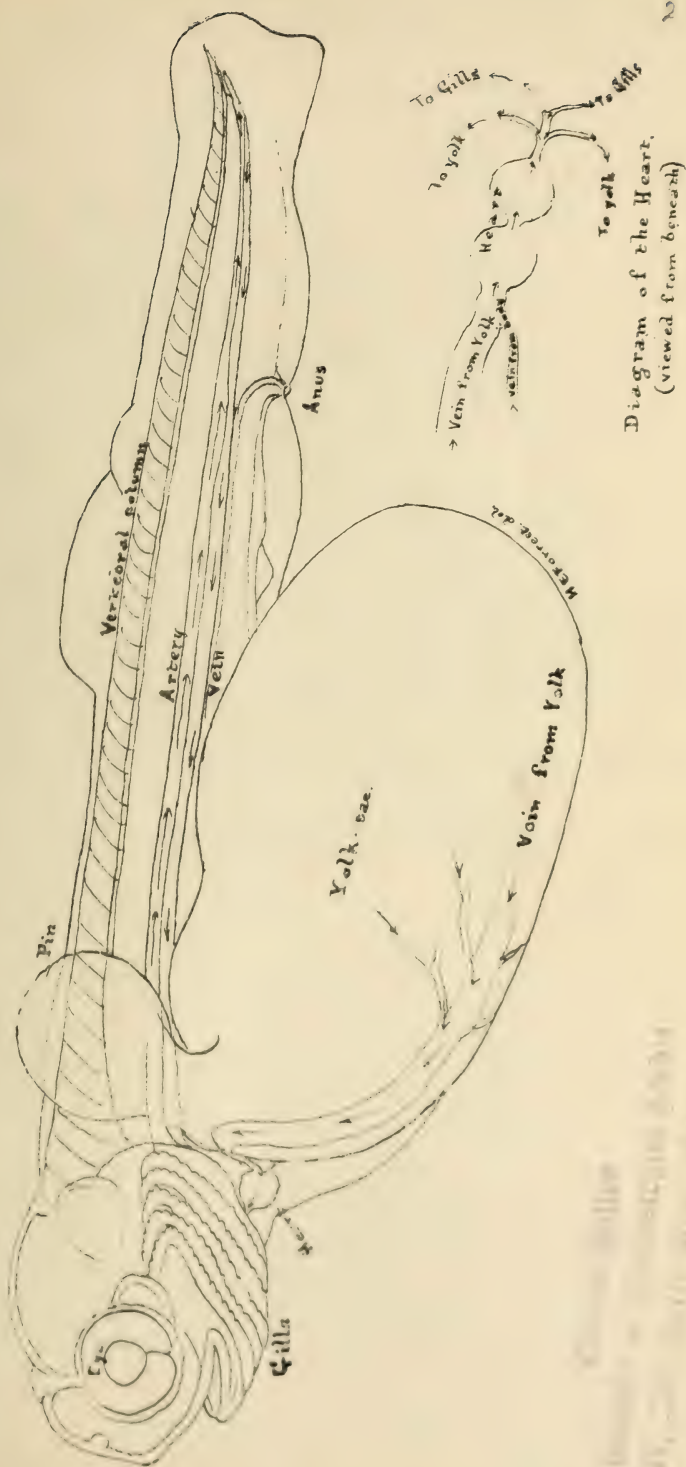
d. Artery which supplies
the body with blood.

e. Vein returning the same
blood to the heart.

f. Vein into which all the ca-
pillaries empty themselves

g. Fat globules.

Diagram of the circulation in an embryo trout.



Draparnaldia glomerata.

The *Draparnaldia* are a very beautiful genus of freshwater algae, having a central or main stem built up of a chain of cells and branching irregularly. The branches are studded with tufts, built up of much smaller chains of cells than those of the main stem. The whole plant is very gelatinous, and of a light green color. The present species grows usually in still or sluggish water, in large lumps or heaps, sometimes as big as a man's hat.

Hence the name "*glomerata*" = heaped. It is distinguished from its common congener, *D. plumosa* by the green tufts on the branches being disposed in open or spreading clusters, instead of linear-lanceolate tufts approximating to the main stem. Each filament terminates in a long whip like thread of extreme transparency. The cells of the main stem are barrel shaped, the green contents forming a broad band in the middle.

Thos. Bolton. 17 Am. Mus. Nat. Hist.

M. L. Fernald



Pinus australis (Lam.)

H. E. Forrest. del.

Choetophora elegans

A genus of Choetophoraceae (Conferoid. Algae), characterized like Draparnaldia by setigerous branched filaments, but differing from the latter by the filaments being imbedded in a gelatinous matrix.

The Choetophora are found in fresh water, forming little green protuberances on stones, sticks, &c., usually bright green.

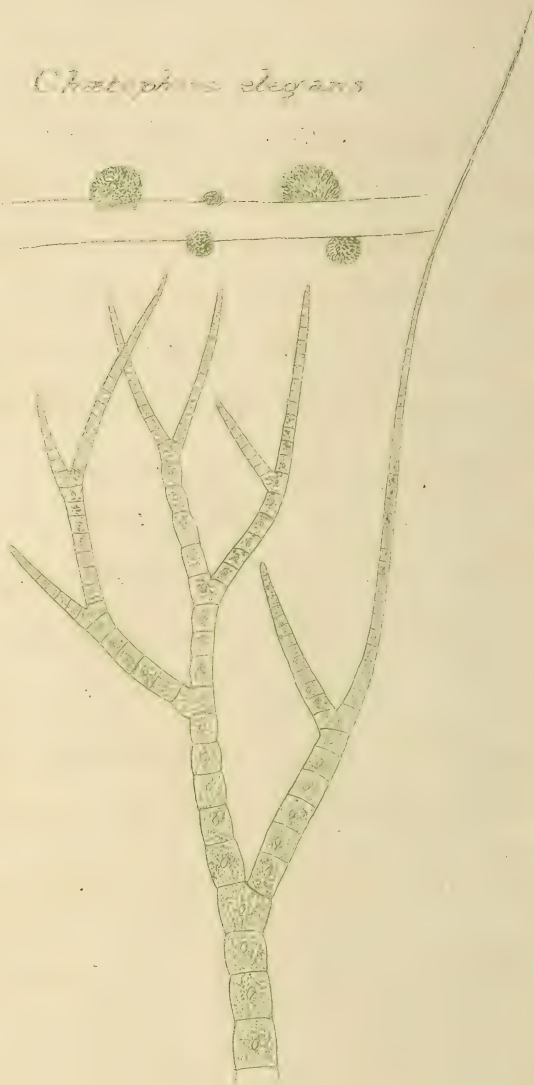
The zoospores are found formed singly in the joints, and bear four cilia.

The membrane of the filaments is very delicate; and the zoospores appear sometimes to escape by its solution.

Micrographic Dictionary.

Thos. Bolton, 17 Ann St Birmingham, April 2^d 1880.

Charophium elegans



Pro-embryo of Chara (or Nitella?)

These young plants grown from spores in my
 vials are I think very interesting. I never
 saw them in this stage before, and they very
 well illustrate a portion of the chapter on
 Characeae at page 278 of Sachs' Text-Book of
 Botany from which I have copied the following
 paragraphs, and W. Forrest has copied figures
 18 and 202 on the other side.

From the central cell of the fruit of Chara
 a sexual leaf-forming plant is not immediately
 developed, but a Pro-embryo precedes it, which
 attains only small dimensions, and consists of
 a single row of cells with limited apical growth.
 The stem of the leaf-bearing Sexual plant springs
 from a cell which lies at some distance from the
 apex of the pro-embryo and grows in a direction
 nearly at right angles to that of its axis.

The root-like structures or Rhizoids spring from
 the outer cells of the lower nodes of the primary shoot,
 and consist of long hyaline sacs growing obliquely
 upwards and elongating only at their apex. The rhizoids
 are segmented by only a few septa which lie
 below the growing apex, and have at first an oblique
 position. The two adjoining cells abut one another like
 human feet placed sole to sole. The branching always
 proceeds only from the lower end of the upper cell
 (fig 202 B); a swelling is here formed which becomes
 cut off by a wall, and by further division produces
 several cells which grow into branches; these therefore
 and on one side like a tuft. The tubular cells com-
 mencing the rhizoids attain a length of from several millimetres
 more than two centimetres, with a thickness of from $\frac{1}{160}$ to $\frac{1}{100}$ mm
 H. B. Bolton. 17 Ann S. Birmingham Mar 9 1886

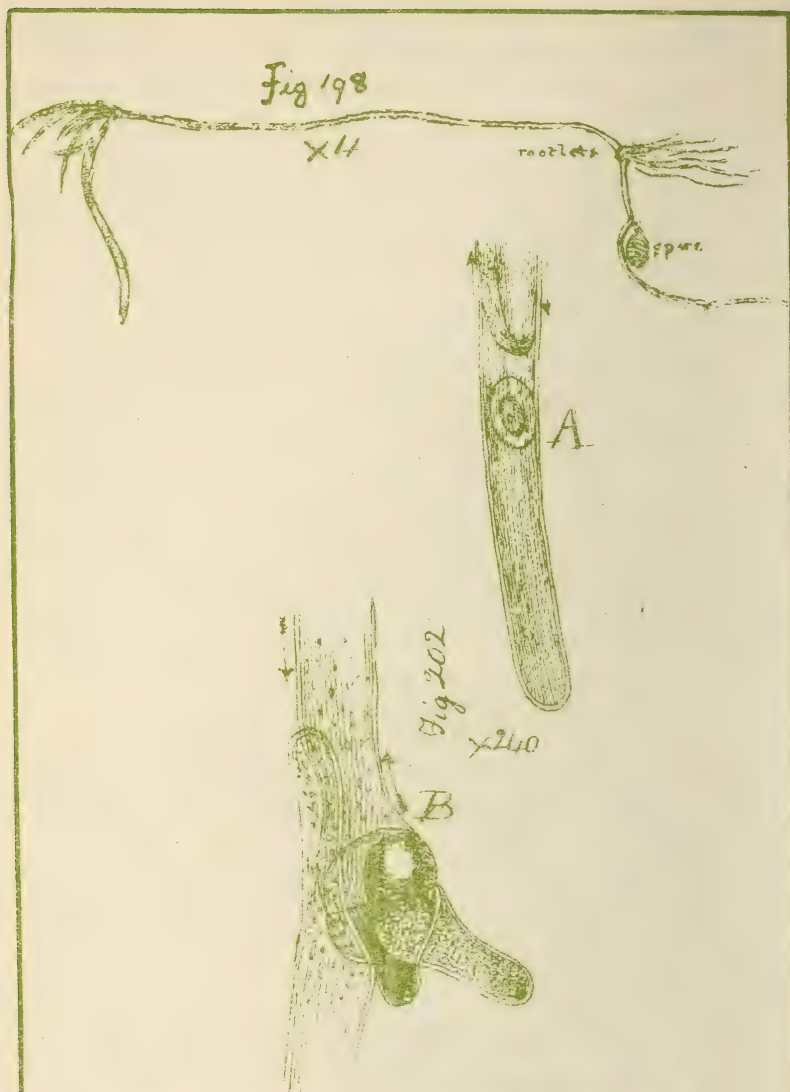
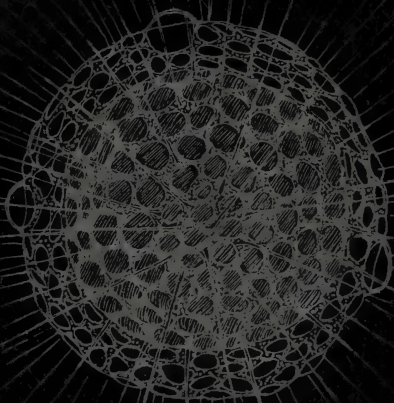


Fig 198. - Pro-embryo of *Chara fragilis*
 Fig 202. Rhizoids A and in process of development. B a "joint" the lower part of the upper cell is branching. The arrows indicate the direction of the currents of protoplasm (after Sachs)

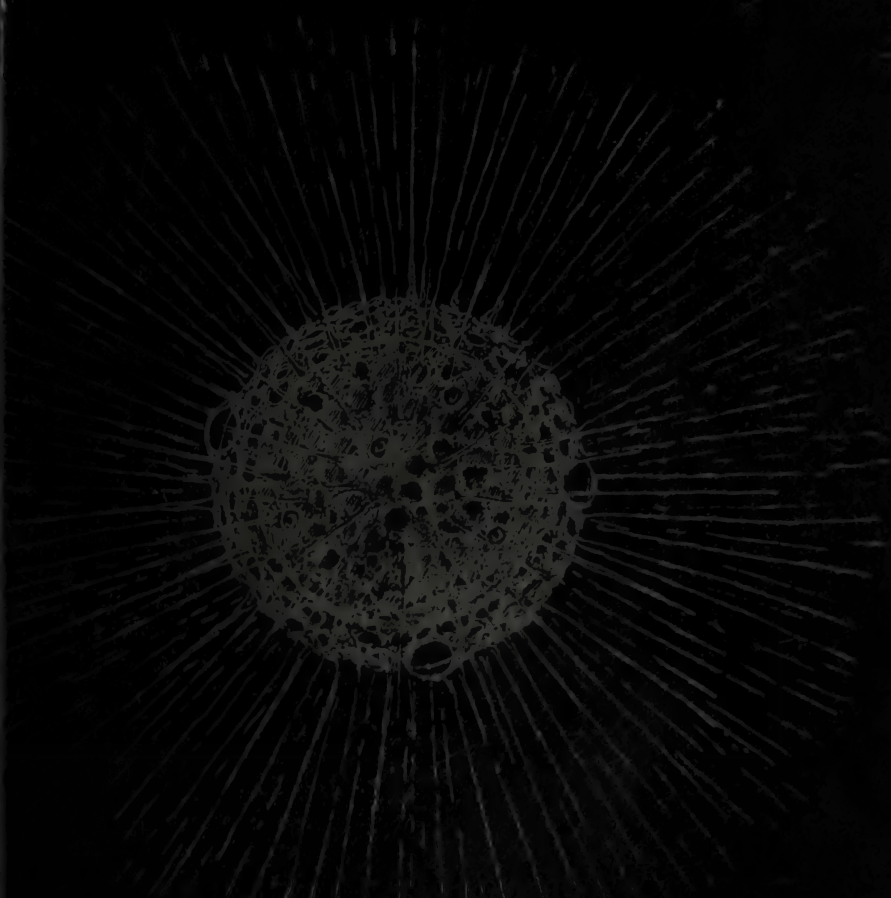
Actinophrys Eichornii of Ehr: or Actinosphoerium E:
Huxley is a Radiolarian found in Fresh water.
Its body is normally globular sometimes lenticular,
composed of sarcode of a frothy consistency & sending out
thin tapering pseudopodia from every part of its
surface. When an infusorian during its rambles touches
one of these it seems paralysed & at the same time
comes fixed to the pseudopodium. The neighbouring
pseudopodia then bend towards it, then point across
above it, & finally bring it to the surface of the body
which slowly opens to receive it & then closes over it,
the prey appearing to "melt" its way into the Actinophrys.
Protozoans & some Infusoria frequently live for some time
after they have been swallowed. Actinophrys multiplies
by fission, and may be artificially multiplied in
this way. When two of them chance to touch one
another they coalesce and become one. I have seen
two, three, and even five of them thus unite, and in
this state they might be mistaken for specimens
undergoing fission. All their movements are
extremely slow. The body is provided with a
variable number of contractile vesicles (3 in the one
figured) which exhibit the characteristic diastole
and systole with great distinctness.

H. E. Foxworth.

Thomas Bolton 17, Monk St. Birmingham



Actinophrys Eichornii



Wm. K. C. del.

Sinosphaerium Eichornii. One of the Radiolaria
 the body exhibits contractile vesicles.
 the movements of the pseudopodia is very slow,
 mules may be seen continually moving in
 in as in *Glomida* and *Toraminifera*, but the
 pulsation is much slower and requires great
 patience and a high power to render it visible.

Micrographical Dictionary
 specimens one shilling per tube post free
 the tube be slowly reversed the specimen
 will be seen floating about in the water as
 with milk-white spheres about the size
 of a pin's head.

Thomas Bolton 17, Great Birmingham

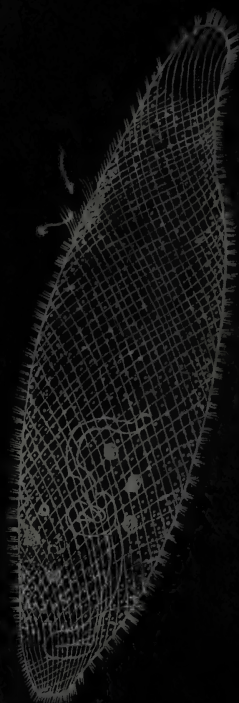
Spirostomum ambiguum

H. E. Fernald del.



Ventral
view.

mouth



Dorsal view.

Flattened between two
glasses to shew the
netted pattern on the
epidermis caused by the
curved lines of cilia which
cross one another diagonally



Side
view.

mouth

3
A few days back a friend brought me some water,
from a duck pond near a farm yard, abounding
with *Engelina viridis* and Infusoria, amongst which
was one species which was new to him, and which,
although I had seen it before, I could not identify
to my own satisfaction. I therefore sent it to
Mr. Bawle Kent, Esq. who writes, - "You may send it
out as a good example of the order of *Hypotricha*,
including Infusoria with cilia developed only on
their lower or ventral surface. It belongs to the
family of *Oxytrichina* of Ehrenberg, and is nearly
allied to *Oxytricha* and *Stylotrichia*."

Mr. Kent has kindly sketched it for me, so I have
the pleasure of sending a print from his drawing
on the other side with specimens of the Infusoria.
Pritchard gives the following description.

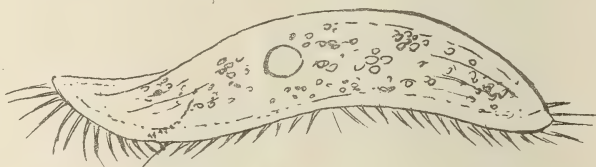
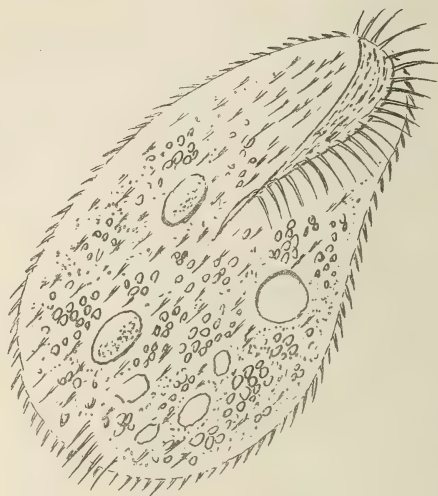
Genus *Urostyla*. - Cilia and styles present, uncinariating;
the cilia are thickly disposed in numerous rows, and are longer
near the mouth. On the ventral surface, at the posterior end, is
a small cleft, provided with non-vibratile setae. Internally
are numerous vacuoles, which may be filled with particles
of colour; a nucleus, a contractile vesicle, and delicate granules.
Transverse self-division has been observed.

Urostyla grandis - White, semicylindrical, rounded at
the ends; slightly enlarged anteriorly, hence club-shaped; styles
short; mouth large, one-fourth to one-third the length of
the body. It has long cilia on both sides; the discharging
orifice has from five to eight little styles on the left side
only; stomach-juice colourless. The young animalcules
are flatter than the old ones {Pritchard in Plate XV fig 342 gives
an under view with glands, vesicle, and the cells filled
with Bacillaria and coloured matter. Cuvier's produced
by the vibration of the cilia about the mouth being also
indicated in the drawing} On slimy dead sedge-leaves.
1/400 to 1/600. - Porty doubts the independent specific character
of this form, and would rather consider it a variety of
Oxytricha fusca, or more probably *O. platyloma* in a
further developed state; for Ehrenberg admits that the
uncini at the posterior extremity are small; and if
so, they can scarcely be characteristic.

I do not myself find any of these Infusoria measure
more than 1/200.

Mr. Kent identifies the Acineta I sent out last week as
Acineta mystacina.

Thomas Bolton, 17 Ann Street, Birmingham. Jan 30 1890



Urostyla grandis. Ehr.

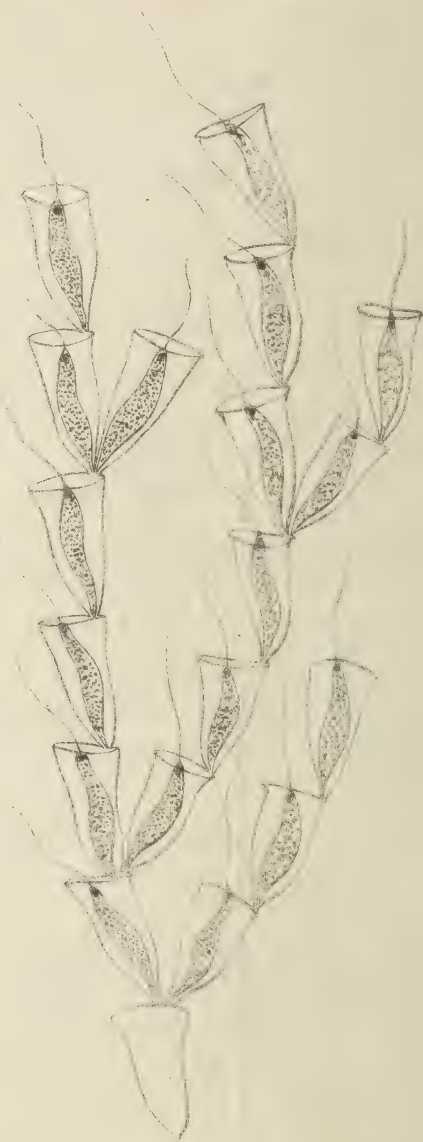
Dinobryon sertularia

Amongst a rich gathering of Volvox globator brought to me by a friend I find a number of these Infusorian animals swimming about. I never saw or at least recognised them before, and I am indebted to W. Seville for their identification. The water also abounds with Tridinium tabulatum, and some few Uroglema volvox figured in my Port Folio 1842. The Dinobryon is described as follows by Pritchard. Genus Dinobryon.—Distinguished from the preceding ones [Epiphytia] by possessing an eye-speck and freedom of motion. The lorica also is larger and looser around the body of the creature. Reproduction takes place by gemmules, which do not separate from the parent; hence a shrubby, forked, and polytre-like cluster is produced.

Dinobryon sertularia.—Lorica (sheath) large, slightly raised and dilated at the mouth, but constricted above the base or the attached extremity. This animalcule is easily overlooked, by reason of its crystalline lorica, and often nearly colourless body; by a patient investigation, however, the little colony may be perceived rolling along, and advancing along in the field of view. With a such lorica pale-yellow animalcule may be noticed, in form somewhat resembling the young of Chlorogonium or of Euglena viridis. The creature is able to contract itself into a rounded mass at the bottom of its case, or it extends itself to the mouth of the lorica but not beyond it. A red speck occurs at the interior part of the body, from which a single thread-like filament is protruded beyond the sheath. The vibrating filaments of the several members of the colony project it through the walls, like so many paddles. In log water. Length of animalcule $\frac{1}{16}$ " cluster 220". Stein in the course of his researches met with a specimen of Dinobryon sertularia which he likened to a Eugleniform being living in a crystalline gellet like sheath much like that of Volvinella crystallina or of Chlamydomonas imbricata. The sheath, grouped on a stem, is only mechanically united together and are under circumstances developed by progressive gemination from the innermost one, as if it were a suppressed. Each being has a clear, homogeneous, discoid nucleus near its base, containing a central nucleolus."

Anna, Bolton 17 Ann Street Birmingham, March 1846

Dinobryon Sertularia.



H. E. Forrest del.

Vorticella chlorostigma.

This pretty little green bell animalcule was found about three weeks back in great abundance, literally covering the weeds, in an old marl-pit, with a rich green coat. They have now in a great measure mysteriously disappeared, as is the habit of many of the Infusoria, although after a diligent search I still found some small patches scattered over the leaves of the *Anacharis Alsinastrium* (now in blossom).

Pritchard describes it as follows. - "Green ovate, conical, campanulate, and annulated; frontal margin (peristome) expanded.

Often covers grasses, and rushes with a beautiful green layer. "stalk five times the length of the body."

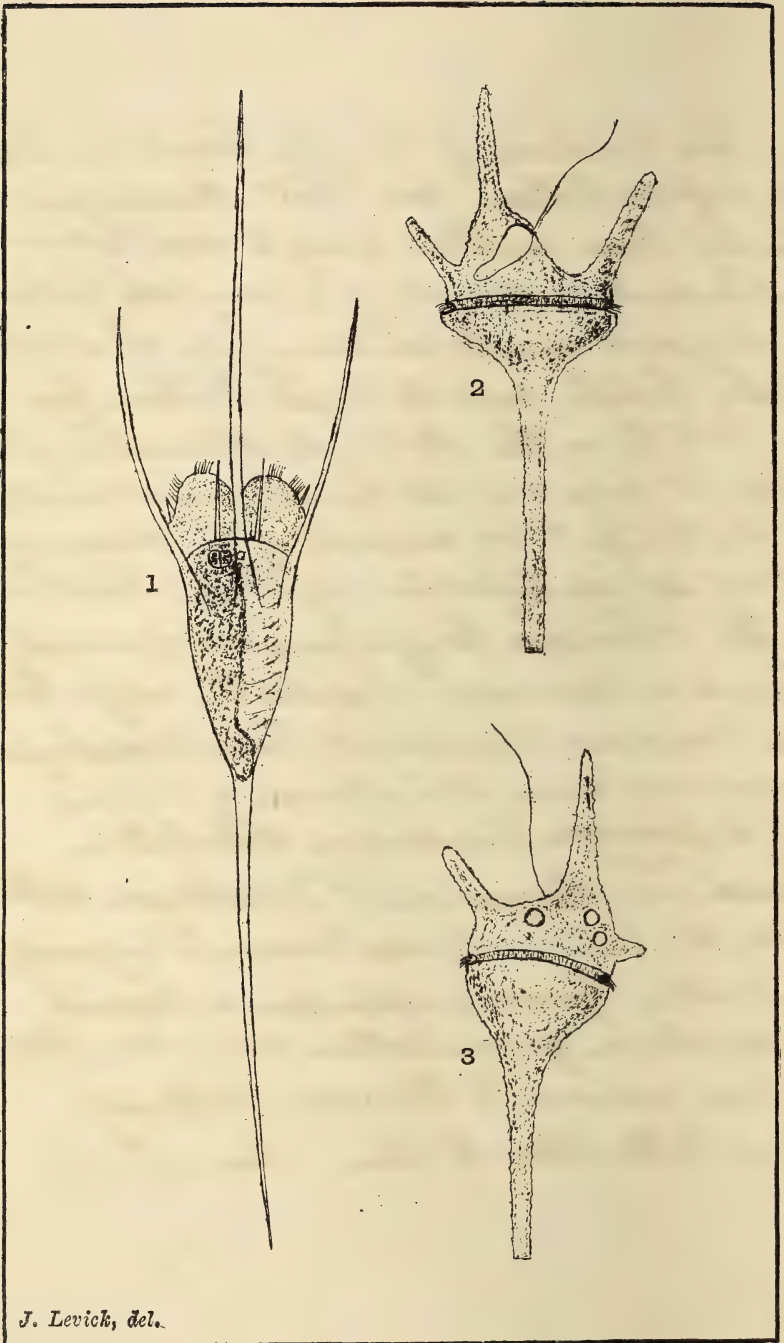
This is the first time I have seen this *Vorticella*.
 Nos. Bolton 14 Ann St. Birmingham. July 2nd 1881.



Porticella chlorostigma.

By the kindness of Mr. John Levick Vice-Pres-
 -ident of our Bham Nat. Hist. & Microscopical
 Society I am enabled to day to send to my cor-
 respondents a sample of a very rich gathering
 he has just made containing an abundance
 of the Rotifer new to Great Britain figured
 in Plate II in the *Midland Naturalist* of Oct.
 1879. At page 241 Mr. Levick gives a description
 of this Rotifer & an account of his discovery of
 it & of its identification by Dr. C. S. Hudson
 as the *Anuraea longispina* only previously
 found in America. Besides this rotifer there
 are *Anuraea stipitata* & *Triarthra longista*
 as well as some other species of Rotifers.
 Of Infusoria, *Peridinium tabulatum*,
Ceratium longicornis, & *Dinobryon sertul-*
-aria, the Entomostraca *Bosmina longirostris*.
 A Diatom *Synedra splendens*, a Desmidi-
-um *Pediastrum granulatum* & also some *Pan-*
-dora morum, & *Gonium pectorale*.
 Thoma, Bolton 17 Am St Bham June 11th 1880.

Plate VI.



J. Levick, del.

A New Rotifer, &c.

MELICERTA RINGENS.

It is a very charming sight, especially to a tyro in microscopy, whose attention is riveted and his wonder excited by the spectacle, to behold one of these animals in full play under a good instrument. Probably, when he first sits down to his observation, he discerns nothing but an opaque or semi-opaque tube standing up like a tall chimney, a little widening upward; for the timid little tenant, alarmed by the shaking of the table produced by the observer's movements in sitting down and preparing, is shrunk down out of sight into his snug castle. In a few moments, however, something peeps from the top; perhaps it is a simple rounded mass of crystal flesh, as in *ceratophylli*; or the long antennal tube of *cephalosiphon* thrust out by jerks, and vigorously thrown to and fro; or the two incurving horns of *ringens* slowly protruding.

Suppose it is the last-named species, the most attractive of all, perhaps I may say the most interesting of the entire class of Rotifera. As the rounded mass of translucent flesh still protrudes, crowned by its two horns, like the spines of a rose, two other organs suddenly appear, stretching out from another part of the convexity, two long clear tubes, extending horizontally, one on each side, which are the feelers or antennæ. Now a quivering is discerned in the interior, and in a moment the extremity opens and unfolds into four wide rounded flat lobes, like the petals of a transparent flower. The plane of this flower-like disk is not horizontal, but more or less oblique, sometimes approaching to perpendicular, and the two petals which are the highest are considerably larger than the two that are lowest; the former being the fore, the latter the hind pair.

No sooner is this lovely flower in full blossom than you perceive the curious furniture of its margin. You cannot help perceiving it; your eye is instantly drawn from every other part to gaze upon this wonderful sight. There is seen a set of black beads on the very edge, each divided by a narrow interspace from its fellows, which are engaged, without a moment's interruption, and with the most perfect regularity, in chasing each other all round the margin. Round and round they go, into the sinuosities, over the projections, with a steady, majestic swiftness which is quite entrancing to behold. If you suppose the crown-wheel of a watch to be made of glass, and the teeth to be painted black, you would have in its movement an appearance somewhat like that of one of the simple disks of the genus, such as that of *crystallinus*; but in this species the case is complicated by the wheel being four-petalled instead of circular. Again, however, you see that the disk itself does not rotate, but the black teeth only, and these change their form in certain parts of their revolution, becoming confused, and then again bursting into distinctness.

It is almost impossible to believe that you do not see an actual rotatory movement of the parts, that the black spots are not real solid organs, they are so palpable, so well defined. Yet it is manifest on a moment's reflection, that such a motion, continued without intermission for hundreds of revolutions, would be perfectly incompatible with the necessary conditions of an animal body. In reality you do not see parts at all; the black spots are only waves in the cilia: an optical illusion produced by the cilia being brought momentarily closer together at certain regular points, causing opacity, and alternating with correspondent separations, causing transparency. These waves run ceaselessly round, but the cilia themselves do not change their place; they merely bend and straighten themselves in rhythmic alternation.

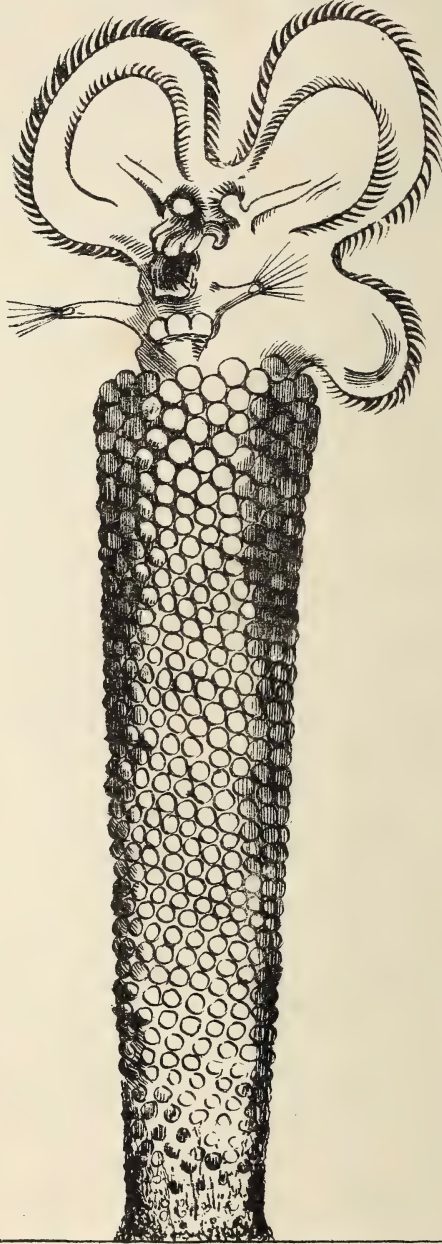
P. H. GOSSE, F.R.S.,

In "Popular Science Review," Vol. I., 1862.

THOMAS BOLTON, 17, Ann Street, Birmingham.

June 4th, 1880.

Melicerta Ringens.



DIRECTIONS.

Examine contents of the glass tube with a pocket lens of about 2 inch focus. The tube cases of the *Melicerta Ringens* (the building Rotifer or wheel animalcule) will be readily seen like little black thorns standing erect from the surface of the leaves of *Anacharis Myriophyllum* or other weed, and often attain the length of a tenth of an inch.

If the tube has been at rest for some time before examination the head or rotatory wreath may be seen protruding from the mouth of the tube as a glistening hyaline object, but as a rule it may not be expected to protrude itself and exhibit its beautiful ciliated wreaths till it has had some hours quiet to recover itself after the continuous shaking it is certain to have experienced during a long journey by post.

After noting (under the pocket lens as above) the position of the several specimens on the weed, it will be well as soon as possible after its receipt by post to transfer the weed by a pair of forceps from the tube in which it arrives to a Zoophyte trough, (about $2\frac{1}{2}$ inches long, $1\frac{1}{2}$ inch high, $\frac{3}{8}$ inch in thickness or depth,) into which the water from the tube is poured, together with sufficient river or soft water to nearly fill it. Examine again with pocket lens, and adjust the weed into a suitable position for the examination of some one or more of the *Melicerta*.

Place the trough, if convenient, at once in the microscope, and let it remain some hours at rest, and doubtless, if not before, it will now be seen to advantage.

In this position it may with advantage be examined with low powers, such as the 3 inch, $1\frac{1}{2}$, and $\frac{3}{8}$, and possibly occasionally, when it is peculiarly well placed, with the 4-10ths objective.

In such a trough it may be expected to live a week or so without change of water, or it may be kept longer in a small saucer, or evaporating dish, or still better in a fresh water aquarium, in which the individual would very likely propagate and increase.

The student should carefully examine the whole of the weed under the low powers in the trough, and it is very likely he will be repaid by seeing some younger individuals just commencing the building of their tube, and he may possibly find others in a still earlier state swimming or creeping amongst the leaves.

[OVER]

For examination of the *Melicerta* under the $\frac{2}{3}$, 4-10th, and $\frac{1}{4}$ inch powers, it may be advantageously placed in a slide trough or tube cell of about 1-6th of an inch or less, covered with thin glass. To do this an individual should be noted on the weed, conveniently placed on a leaf, or, still better, on the stem. With a small pair of nail scissors, the leaf on which the individual is placed should be cut off the weed, leaving a small piece of the stem attached, and so transferred to the trough or cell. It may sometimes be necessary, with the scissors, to pare down or split the leaf carefully without injuring the specimens, so as to reduce the leaf to a less width than the depth of the trough or cell. This being done, the leaf can be placed in the trough or cell sideways, and the piece of stem attached to it retains it in that position, otherwise the *Melicerta* tube, which is generally built in a position standing up from the surface of the leaf, would not be conveniently placed for examination.

This manipulation may be very conveniently carried on in a deep watch glass, under a dissecting microscope.

If a slide trough or tube cell be not at hand, the individual so selected may be placed in the ordinary animalcule cage or compressor, and for the highest powers this arrangement is best.

The slide trough arrangement has a great advantage in having the object in a more natural position, and in which it will live the longer. Moreover, when not wanted for examination under the microscope, it may conveniently be transferred to a basin of river water, or still better suspended in an aquarium. In this way an individual may be kept alive for some time, and its life history watched, and possibly young ones may be propagated and attach themselves to the weed or even to the glass.

When the *Melicerta* is found on *Myriophyllum*, it cannot be better exhibited than by taking a single leaf, placing it on a slip of glass (with ledge) with a little water, cutting off any little fibre of the leaf which might interfere with the examination of the specimens, and then covering them with glass.

In this way it can be viewed with the highest powers, and can be beautifully illuminated with the centrally-stopped Parabolic Reflector, or with the spot lens.

The student will find that individuals grown in confinement build their tubes of much more transparent materials, and therefore are much better adapted for examination.

OBJECTS NEARLY ALWAYS AVAILABLE FOR TRANSMISSION
BY POST.

Rotifers	{ Melicerta Ringens Philodina Roseola	} Either of these Species in Glass Tube, enclosed in wood case, 1s.
Polypes	{ Hydra Vulgaris Hydra Viridis	
Entomostraca,	{ Cyclops Daphnia	
	{ Cypris Canthocamptus	

Occasionally :—

Rotifers	{ Limmias ceratophylli
	{ Œcistes crystallinus
	{ Floscularia cornuta
	{ Stephanoceros Eichornii
	{ Euchlanis dilata
	{ Salpina mucronata
	{ Brachionus urceolaris
	{ Pterodina patina

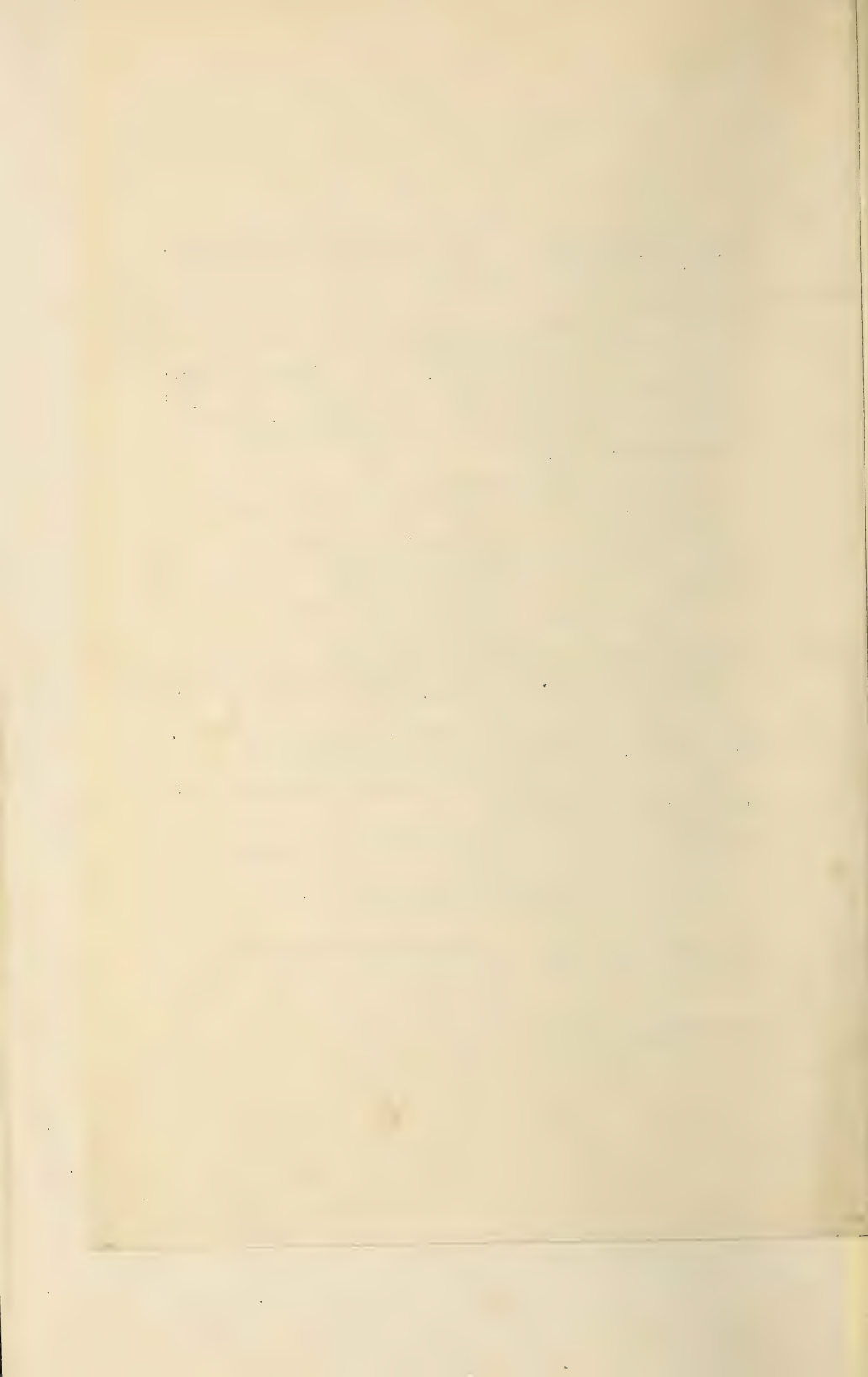
Fresh Water Polyzoa, Plumatella Repens; Stentor Mulleri, Volvox Globator, and many varieties of Infusorial Life.

Rare, (but, when they are found, occasionally very abundant,) Lacinularia Socialis.

Nitella translucens, shewing the circulation of the sap.

THOMAS BOLTON,

Hyde House, Stourbridge.



Lacinnularia socialis

This species of the Rotifers is one of the largest and most interesting of the Order. Professor Huxley writes a long descriptive paper on this and its allies in the first Volume of the Quarterly Journal Microscopical Science 1852. It is found attached in clusters (fig 11) to submerged plants.

V.P. H. Gosse in his History of the Rotifera in the 1st Volume of the Popular Science Review 1862 gives me good hints as to their examination.

Having placed a group of *Lacinnularia* in one of my small Zoophyte troughs, rub a cake of water-colour carmine on a palette, and with a sable pencil take up a minute portion, and diffuse in the water in the trough. As soon as the little animals recommence their ciliary motion, the dark-red atoms of pigment are put in motion, and you see at once that you have obtained very important aid in distinguishing the currents. If you have not diffused too much paint the animals will continue their rotations without inconvenience, and the transparency of the water will not be materially affected. The result is immediate and striking. Particles of red pigment are drawn from all quarters towards the disk, on approaching which they arrange themselves in a wide band, which is hurled round in directions parallel to the sinuations of the margin, leaving a uniform distance just outside the ever-advancing black wave-specks.

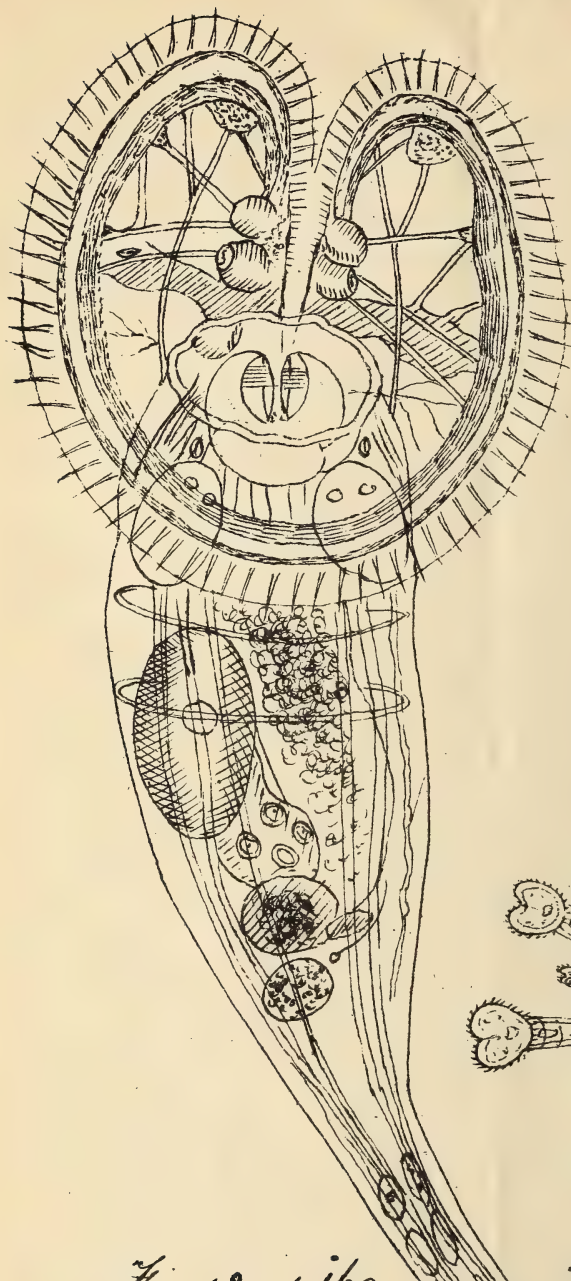


Fig. 12 $\times 160$.

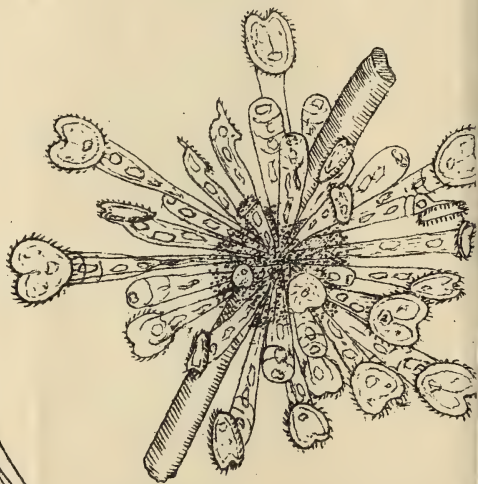


Fig. 11

$\times 15$.

Fig. 11 *Lacinularia socialis* group
 Fig. 12 *Lacinularia socialis* individual

Alcyonella fungosa

³³ *Alcyonella fungosa* presents itself in the form of brown fungoid masses of very variable size and shape, attached to the surface of different fixed objects, as stones, pieces of wood, fresh-water shells, &c. The masses frequently acquire a considerable size, weighing upwards of a pound. They are often irregularly lobed, and when they grow upon the surface of a cylindrical body, as a twig on the stem of some aquatic plant, usually surround it so as to assume a somewhat spindle-shaped figure, gradually diminishing in thickness from the centre towards the extremities. They are fond of attaching themselves to the branches of trees which dip into the water, and then constantly exhibit lobed, pear-shaped masses pendent from the extremities of the sprays. (from Hilman's Iconographi)

Thomas Bolton, & Ann R. Birmingham.

ALCYONELLA FUNGOSA.



3

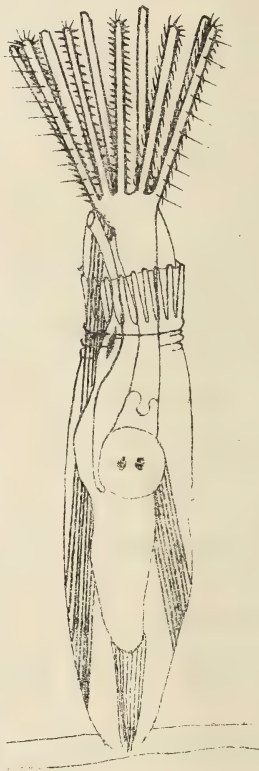
Bowerbankia Gracillima.

Stem creeping, rather stout, and sinuous. Loxecia disposed in groups of varying size at intervals, slender, elongate-oval when contracted, flask-shaped when the polypide is extended, rounded off below, of a light horn-colour. - Polypide with 8 tentacles. The cells originate on the sides of creeping stem, but are not regularly biserial; they are very slender and graceful in form. The gizzard is very conspicuous. Along the back of each tentacle runs a line of very delicate setae; and two or three stand out very prominently at the extremity. A very long bristle also projects at the base, and is visible standing out on each side at the bottom of the tentacular bell.

Hutchinson's Marine Polypoa.

Thos. Bolton, of Ann St. Birmingham.

Bowerbankia Gracilima



Bosmina longirostris

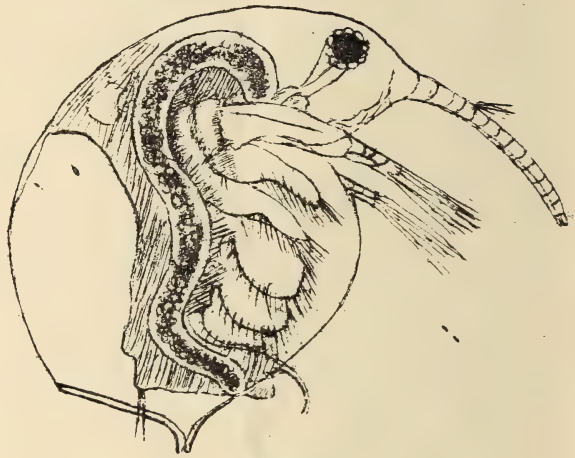
3

This animal is very small. The shell or carapace is rounded on the posterior margin, bulging out anteriorly, & terminating at the inferior angle in a sharp point or spine, which projects straight downwards. The superior antennae consist of 20 articulations; the first 7 are short and close to each other; at the 7th two or three setae spring, projecting forward and upwards; then follow 13 articulations, each one longer than the preceding. Like the antennules of the Daphniadae and Lynceidae, they appear to be almost destitute of motion, and thus when seen close to each other, they certainly bear a close resemblance to a prolongation of the beak. The inferior antennae, though strong bodies, are much shorter than in most of the Daphniadae. The anterior branch has 4 articulations, the posterior only 3. They all form a fan with long filaments, which are not plumose. The ocelli are few in number.

The motion of this curious little creature through the water is caused by numerous and very rapid strokes of its inferior antennae or rami, being in that respect very similar to the Lynceae. {David's Entomostreacae} These entomostreacae sent out today will be found to be encrusted with innumerable dark green monads, almost motionless whilst attached, but soon after swim about very actively & somewhat like *Euglena viridis*. What are they?

Thos Butler 17 am 513 Birmingham

Oct 24 1879



Bosmina longirostris

3

Young Shrimp
Crangon Vulgaris

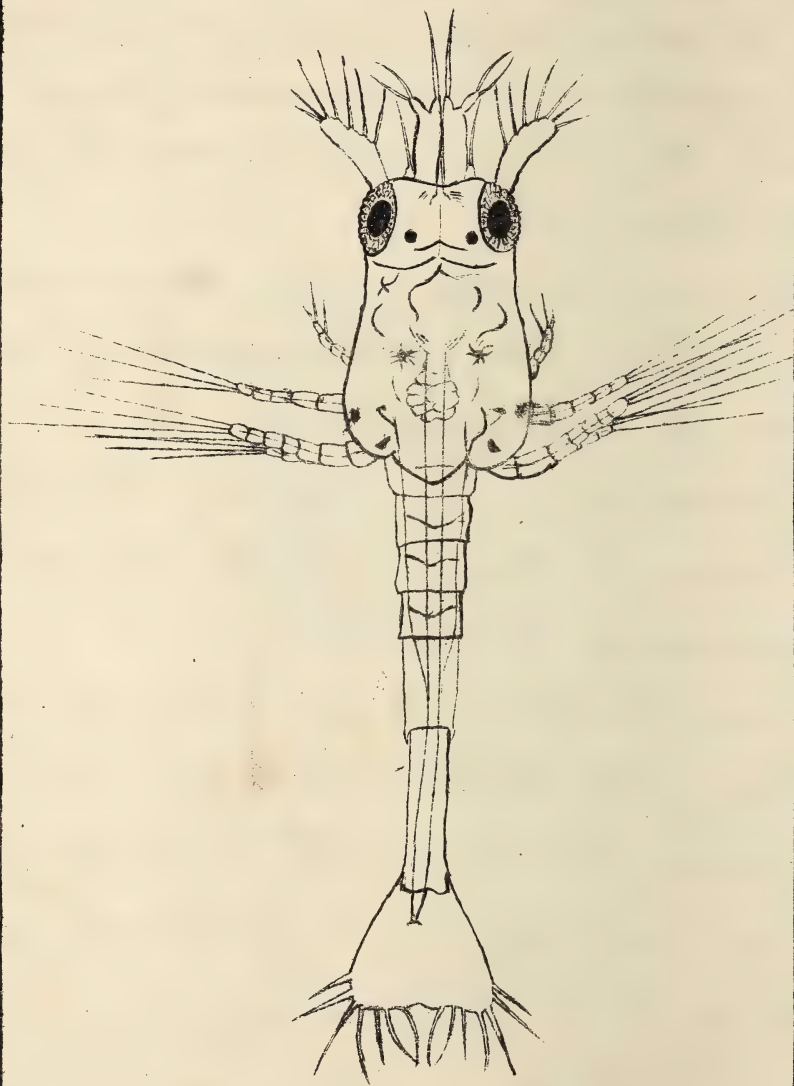
This larval form of the common Shrimp in its earliest Stage is interesting as shewing the remarkable transformation through which the young of all the members of the Crustacea pass.

These very much resemble the young of the Lobster. The Metamorphoses of the Shrimp and Lobster, are however not so great as in the common Shore Crab but more to them and the common fresh-water Crayfish.

A most interesting account of the Embryology of the latter will be found in Professor Huxley's work on the Crayfish as an introduction to the Study of Zoology.

Thomas Bolton 17 Ann St. Birmingham.

Larva (Zoea) of Shrimp (Crangon)

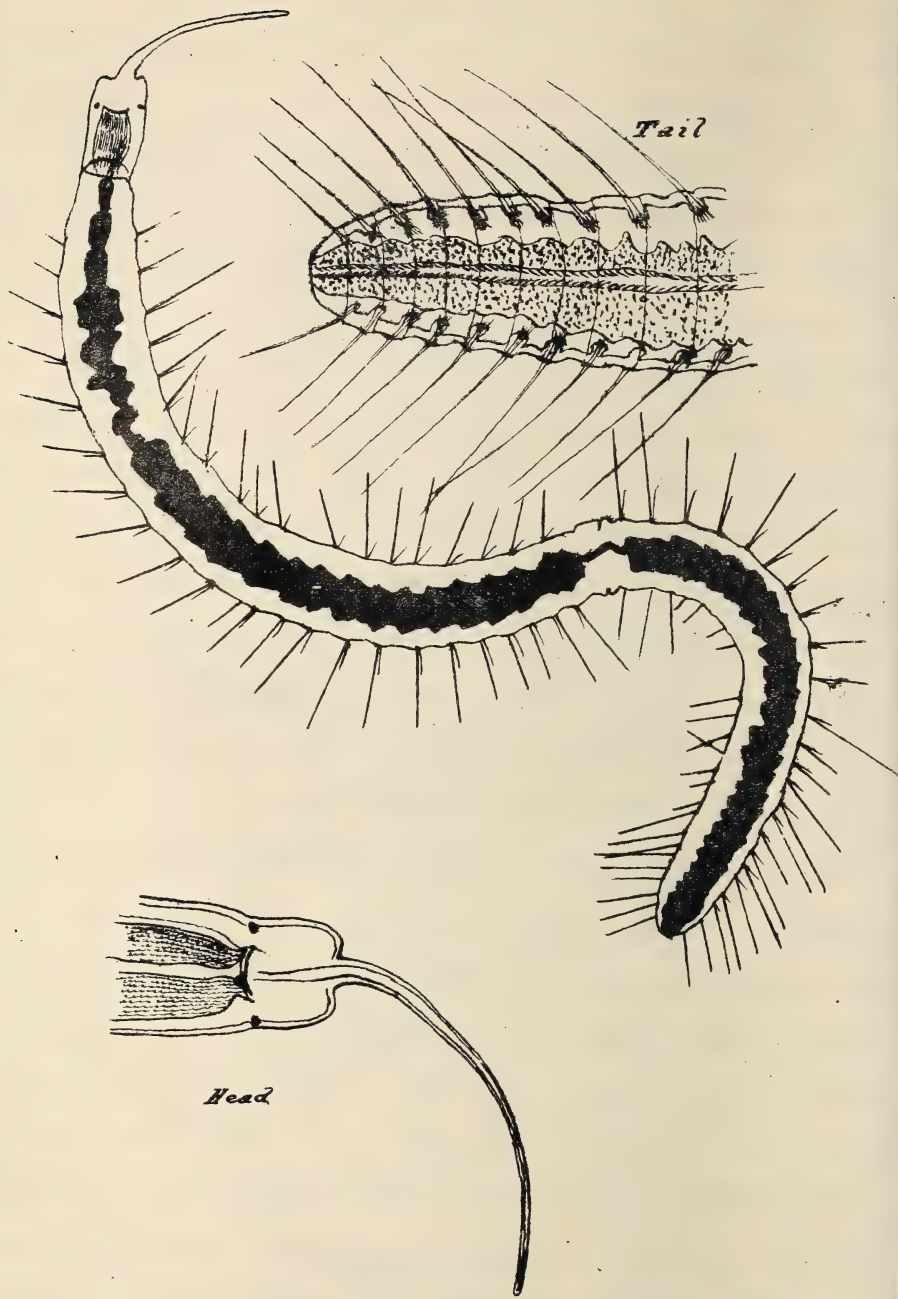


H. E. Forrest del

Nais proboscidea.

This freshwater worm will I think be found interesting to my subscribers although very common this class has not been much studied by English students. I do not remember any illustration of it in any English book. There are several points of special interest. Almost every specimen shows some stage of the curious agamic multiplication. When about to divide into two, the alimentary canal becomes constricted, as in the one figured, & finally separates. A mouth is then formed over this point, and a proboscis like that of the head of the original appears. At this stage if the worm be irritated it will immediately break into two halves each complete in itself. Indeed all the organs are perfectly formed before the separation takes place. The proboscis has only the function of a feeler, the mouth being situated behind the base of it. This worm shews very beautifully the peristaltic action of the intestine & stomach which takes place in all animals. The inside of the alimentary canal, especially towards the anal end is thickly clothed with large cilia which are always in motion. It has two eyes one on each side of the mouth. There are no feet but each segment of the body is provided with two long and two short bristles which serve as locomotive organs. The muscles and their action are also seen with great distinctness.

Thomas Bolton, 14 Ann St. Birmingham July 16th 1850.



Nais proboscidea

M.E.F.

February, 1881.]

[No. 4.]

PORTFOLIO OF DRAWINGS,

AND DESCRIPTIONS OF

LIVING ORGANISMS,

(ANIMAL AND VEGETABLE,)

ILLUSTRATIVE OF

FRESHWATER AND MARINE LIFE,

WHICH HAVE BEEN SENT OUT WITH THE LIVING SPECIMENS BY

THOMAS BOLTON, F.R.M.S.,

57, NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING.

CONTENTS:

VEGETABLE KINGDOM.

Desmids and Diatoms.	Zygnema cruciata.
Æcidium urticæ.	Vallisneria spiralis.

ANIMAL KINGDOM.

Acineta.	Spirostomum teres.
Dendrosoma radians.	Cordylophora lacustris.
Choano-flagellata.	Lucernaria auricula.
Bursaria truncatella.	Euchlanis dilatata.
Marine Infusoria.	Asellus vulgaris.
Nassula ornata.	Hyocryptus sordidus.
	Argulus foliaceus.

LONDON: DAVID BOGUE, 3, ST. MARTIN'S PLACE, W.C.

NOTICE OF REMOVAL.

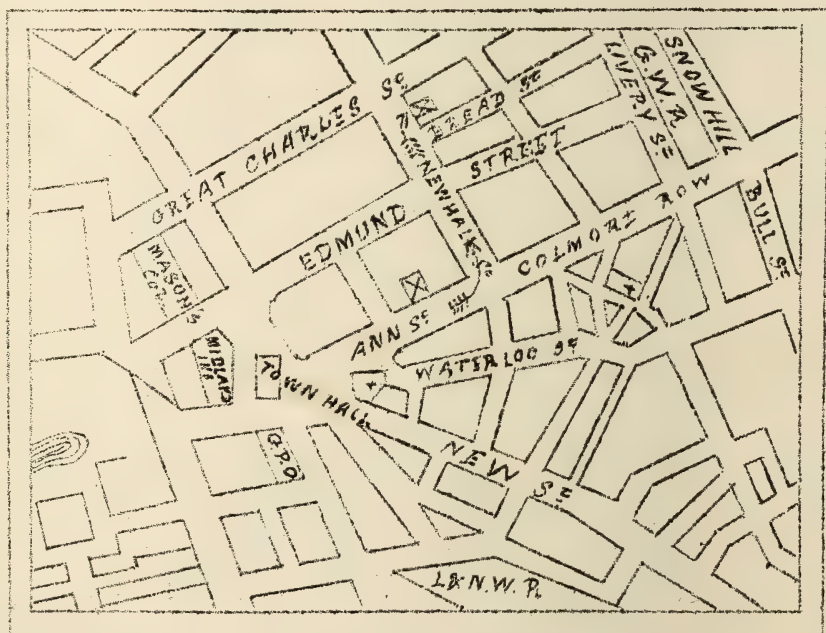
THOMAS BOLTON, F.R.M.S.,

Begs respectfully to inform his friends
that he has REMOVED from 17, ANN STREET,

To

57, NEWHALL STREET

as shewn on Plan below.



Thousands of this printed from one writing

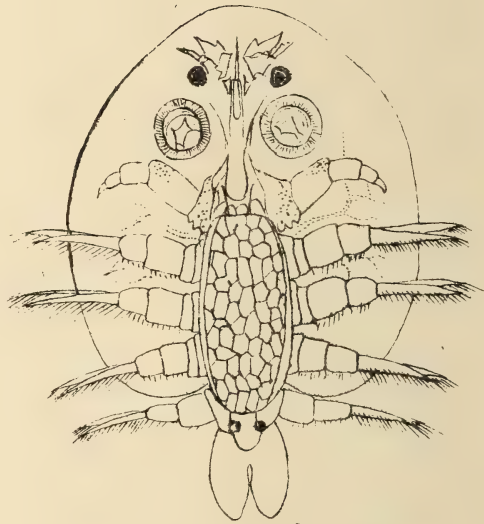
Specimen of Typographic Printing

Argulus foliaceus.

A genus of Crustacea, of the order
Liphonostoma and family Argulidae.
Carapace membranous, covering the
cephalothorax like a shield; antennae
four, short, concealed beneath the carapace,
anterior two-jointed, terminal joint hooked;
posterior four-jointed; rostrum acuminate;
five pairs of legs, the place of the first (6th)
pair being occupied by two suckers, second
pair short, five-jointed, the two basal joints
spinous, the last joint with two small hooks,
the last four pairs of legs two-cleft, and
furnished with ciliated filiform processes.
The Argulus is usually found parasitic
on fresh-water fish, and are often called
fish-lice.

Thomas Bolton, 54, Newhall St. Birmingham

Argulus foliaceus.



H E Forrester del.

ON A RARE BRITISH ENTOMOSTRACON, *ILYOCRYPTUS SORDIDUS*.*

BY H. E. FORREST, F.R.M.S.

Ilyocryptus sordidus has been found in Russia, Norway, Denmark, and Bohemia; at Dantzic, Vienna, and at Sedgefield in the county of Durham. It was found in the last-named place in 1863, and described and figured in the "Annals and Magazine of Natural History, 1863," p. 415, by the Rev. A. M. Norman.

On the 22nd November, 1879, Mr. Bolton showed me an Entomostracon which at the time was unknown to me, but which I have since ascertained to be *Ilyocryptus sordidus*. I have to acknowledge with thanks the kind assistance of Professor A. Weismann in determining the species.

There are three known species of the genus, of which a full account has been published by W. Kurz in "Zeitschrift für wissenschaftliche Zoologie," supplement to Band xxx., 1878.

The shape of the valves of the carapace is oval, and they are very convex, so that the thickness of the body when viewed edgeways is so great as to make it appear almost spheroidal. Their surface is reticulated all over with polygonal, mostly hexagonal markings, which are not shown in the figure. Length from top of head to bottom of carapace 1.80", breadth 1.100". Colour brick red. The head is bounded by a gentle curve behind, abruptly truncate in front. There are two eyes, one compound (*m*) near the apex of the head, and one smaller simple eye (*n*) below it. The antennules (*k*) are tolerably large, and spring from the forehead just below the small eye. The antennæ (*l*) are very large and fleshy and divided into two branches, the upper one four-jointed, with three long setæ and a short spine on the terminal joint; the lower one three-jointed, the first two joints each with one seta, the terminal joint like that of the other branch. *None of these setæ are plumose.* The base of each antenna also bears two spines. Perhaps the most marked feature of the animal is the bristles with which the edges of the carapace valves are fringed. These are set in an unbroken row from just below the mandibles to the junction of the valves behind. They are flexible, rather stiff, and branched *but not plumose*, varying in length from about 1.500" along the front of the body to about half that size along the posterior edge. The abdomen bears as usual one pair of mandibles, (*a*), five pairs of branchial limbs, (*p*, 1—5,) and a very large post-abdomen (*g*) terminating in two long rather straight hooks. This part of the body is larger than in any other species of the family with which I am acquainted, and is capable of a very wide range of motion, at times being extended quite outside the valves of the carapace, backwards, at other times thrust upwards within the carapace till the end touches the antennules.

REFERENCES TO PLATE I.

Fig. 1. FEMALE.

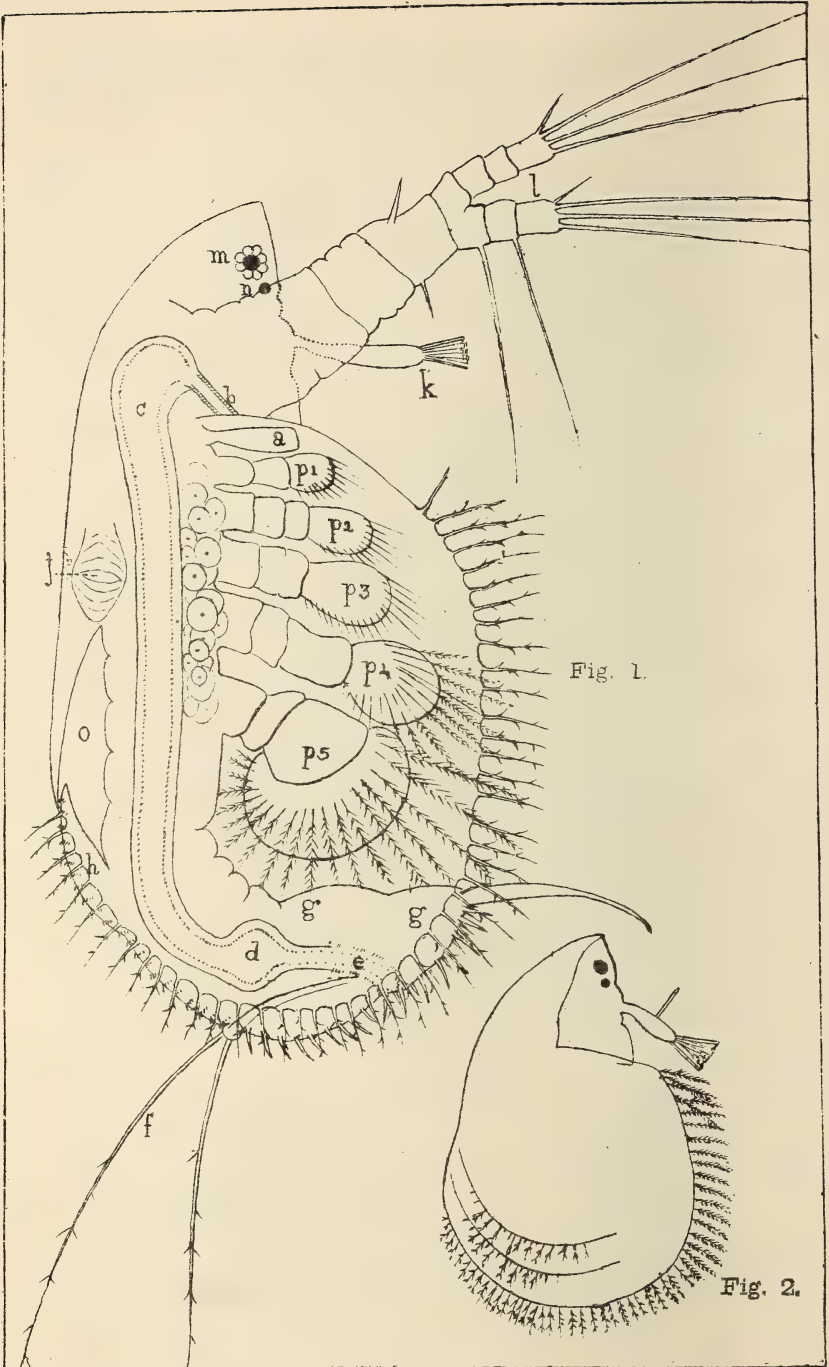
- a* Mandible
- b* Oesophagus
- c* Stomach
- d* Rectal-bladder
- e* Rectum
- f* Post-abdominal bristles
- g* Post-abdomen
- h* Abdominal hook

- j* Heart or dorsal vessel
- k* Antennules
- l* Antennæ
- m* Compound eye
- n* Simple eye
- o* Space in which eggs are carried
- p* 1—5 Branchial limbs

Fig. 2. MALE, after KURTZ.

* Read before the Birmingham Natural History and Microscopical Society November 30th, 1880.

PLATE I.



H. E. Forrest, del.

Nlyocryptus sordidus.

Asellus vulgaris (The water wood louse).

A genus of Crustacea, of the family Isopoda.

Char. Antennae four, buter much longer than the inner ones; legs shorter than the body, the first pair not chelate; two posterior projecting bifurcate abdominal appendages. Length $\frac{1}{4}$ to $\frac{1}{2}$ in long.

This animal is particularly interesting to the Microscopist, on account of its forming the most readily procurable object for examining the dorsal vessel and circulating liquid in motion. The currents of the circulating liquid, with the colourless corpuscles, are readily seen streaming through every part of the body. Beneath the large scutiform joint of body (the abdomen), are three flattened branching false legs or gills on each side, covered by two jointed gill covers; these are in almost constant motion during life.

The above description is taken from the Micrographic Dictionary, but the outline drawing on the other side has been drawn for me by M. Forrest from life.

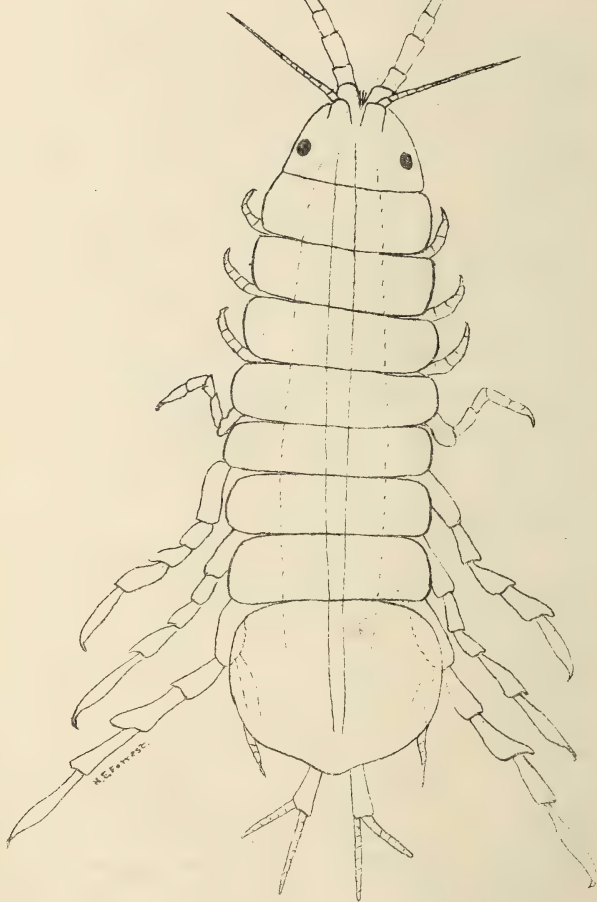
I would call the attention of my correspondents to the rotifers and Vorticellae parasitic or rather commensal upon these Aselli.

Place a specimen on its back in an animalcule cage or Compressorium and examine carefully with $\frac{1}{2}$ or $\frac{2}{3}$ objective the underside of its carapace amongst the legs also round the mouth and anus. On most specimens at least half a dozen species of Rotifers are present including Rotifer vulgaris, Rotifer inflatus, in abundance, two species of Herodias, Brachionus, Euchlamis, Notommatia &c.

In one specimen I found the circulating fluid full of living mounds in much greater abundance than the corpuscles, of an oval shape about $\frac{1}{2000}$ of an inch long. They did not appear in any way to incommodate their host.

The Bolton, 7 Ann Street Birmingham, Dec 17/1880

Asellus aquaticus.

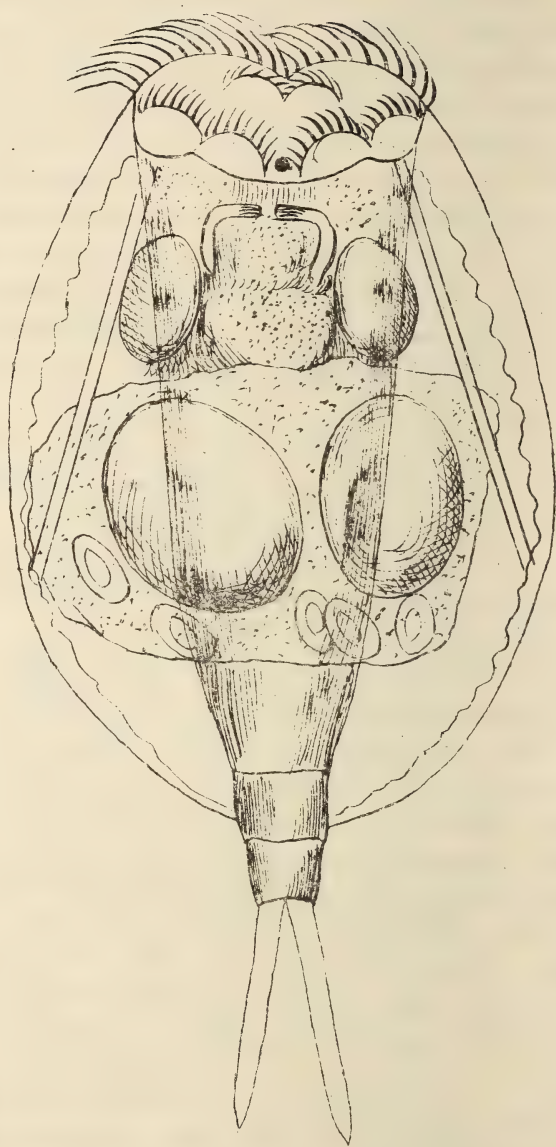


Euchlanis dilatata.

ica resembling a tortoise-shell; according to Cohn slit inferiorly, as described by Ehrenberg. Dorsal & ventral plates united along the sides, forming an te ridge, leaving a fissure, posteriorly, for the foot. al plate the largest. Frontal portion of the animal actile within the lorica; deeply cleft on its ventral ect, with the oral orifice at the bottom of the cleft. anded anteriorly into lappets supporting hooked bristles. either side is a conical process terminated by a long l seta. Oesophagus capacious; jaws resembling those of Hydatina and Brachionus. Stomach thick and nded, with two small spherical glands. Intestine form, ending in a cloaca at the posterior border of the tral plate; both ciliated. Contractile vesicle opening to the cloaca, sending up on each side a coiled water-el with about four vibratile tags. Longitudinal muscles, ng, striated. A large trapezoid cellulo-granular n in the head, with a red speck near its front emity, and on each side a long, finely granular ular appendage. Tail with three telescope segments, ing in two long knife-like toes.

Euchlanis dilatata (Brachionus, M.).—Lorica broad, ressed, folded on the under side; foot without setae; long. This animalcule, when it emerges from the, has a very soft lorica, and resembles *Notommata*. n states that the males of *E. dilatata* are like the ales, only smaller and more slender, as well as more pparent from the absence of mouth, oesophageal bulb & intestine. The testis of the male occupies the centre he body, and is a lancet-like elongated sac, nding from the cloaca to the cerebral ganglion, & filled with rod-like spermatozoa. At its posterior emity it is in connexion with a reniform body ounding and opening into the penis. The latter a thick wall and a ciliated canal protruding as as the first segment of the tail. (Pritchard's Infusoria)

mas Bolton, 54, Nicholl St. Birmingham.

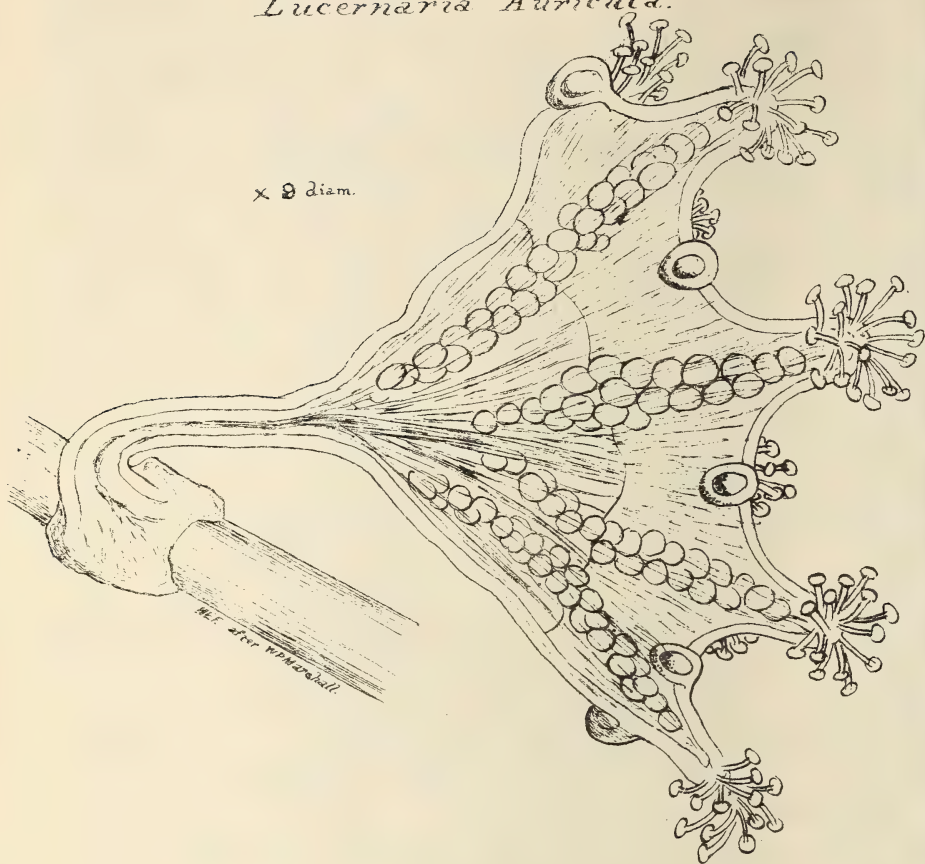


Eucalanus dilatatus

W. C. Parkinson, who has favoured me with some
specimens of this interesting organism says he
is "Notes on the Lucernariadae" in the June ¹⁸⁸⁰
number of "Science Gossip". This family of
the order Anthoxoa helianthoida is of great
interest, yet probably less known than most of the
same class of marine Zoophytes. From my experience
on the Isle of Wight, the Lucernariae are easily met
with, being generally distributed about low-
water mark, visible to the naked eye, and easily
conferred alive from the algae to which they
attach themselves, to the aquarium; they are
hardy, and will live for a long time if
the aquarium is maintained in a healthy
condition. Johnston gives the following
description of the Lucernaria; — Body
amphiplicate, fixed, when at rest, by a
narrow disk or stalk; mouth quadrangular
in the expansion. tentacula disposed in tufts
at regular distances on the margin, oviparous,
having internal ovaries.

Lucernaria auriculo is easily recognised
by a globular tuft growing on the rim of the
cup between the tentacles. The ova are
distinctly visible, giving the animal a
mottled appearance through the semi-transparent
substance. The colour is of various shades of
brown, but it has been found pure white.

Lucernaria Auricula.



One of the Discophora (Jelly-fishes) which is described by Professor Huxley in his *Anatomy of Invertebrate Animals* as fixed by the aboral side of its umbrella by means of a longer or shorter peduncle. The umbrella is divided into eight lobes, at the extremities of which there is a group of short tentacles. The Hydranth stands up in the centre of the umbrella, and its cavity communicates with a central chamber, whence four wide chambers pass into the lobes. These chambers ^{are} separated by septa, the free central edges of which are beset with slender tentacles. The reproductive organs are double radiating series of thickenings of the wall of each chamber.

Thos Bolton, 17 Corn St Birmingham. July 10 1879

Cordylophora lacustris.

The only fresh-water Hydrozoa.

This interesting organism is very fully figured and described by Prof. Allman in the Transactions of the Royal Society 1853. A copy of a portion of one of these figures is given on the other side. It is also figured and described in Dr. Carpenter's Revelations of the Microscope and some interesting remarks upon it will be found in Huxley's Invertebrata. - Char. Polygidom horny, branched, rooted by a creeping tubular fibre; branches tubular; polypes existing at the extremities of the branches ovoid, the mouth at the distal extremity, and furnished with scattered filiform tentacula. (Allman)

J. Bolton, 57, Newhall St Birmingham

Spirostomum tere.



I send herewith some water containing amongst other Infusoria a species I had not noticed before which Mr. Forrest has drawn for me magnified 150 dia^m. Mr. W. Saville Kent has identified it as *Spirostomum* *teres* of Claparède and Lachman. It is only about half the length of the *Spirostomum ambiguum* which I sent out with sketch and description in February 1879. *Paramecium aurelia* figured by Mr. Kent in my Portfolio N^o. 1 is pretty freely present and there are great numbers of the *Colpidium cucullus* of which I sent out specimens in October last. I would call my subscribers attention to the Trichocysts, which Mr. Kent describes at page 80 of his Manual, in *Paramecium aurelia* as "taking the form of minute and exceedingly slender rod-like bodies, or fibrillæ, crowded together and distributed in an even layer immediately beneath the cuticle throughout the whole extent of the cortex, their disposition with respect to the external periphery being everywhere perpendicular. Under certain conditions, including the application of artificial stimuli, such as weak acetic acid, these trichocysts become suddenly elongated and their distal ends piercing the overlying cuticle stand out like fine, stiff, hair-like setæ, beyond the cilia, around the entire circumference of the animalcule, frequently becoming entirely separated from their base of attachment." Dec^r 3rd 1880.

Since writing the above Mr. Kent has identified another infusorian pretty abundant in this water as *Euglena* *acis* of Ehrenberg, and he also finds in it *Distigma proteus* like a transparent *Euglena viridis* enclosed dark granules and having two flagella, also constantly changing its shape as it swims through the water.

Thomas Bolton, 17 Ann St. Birmingham.

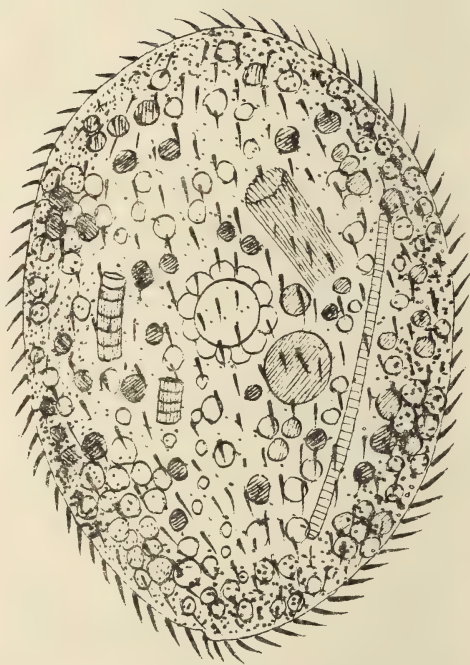
Nassula elegans.

These active little Infusoria will be readily recognised with the pocket lens swimming about in the tube. Pritchard describes them.

— Ovale or globular, depressed, of a brownish green colour, variegated with numerous violet speckles. The animalcule swims backwards, and forward, turning upon its longitudinal axis. The mouth is easily perceived by the currents when indigo is mixed with the water; it has a circle containing twenty-six little warts or teeth, which can voluntarily diverge or converge anteriorly. The posterior part of the body has a small excavation. Ehrenberg says there are from six to eight groups of vesicles, forming a wide circle round the mouth, filled with a violet-coloured juice, which is discharged with the excreta, and appears like drops of oil, but soon mixes with and colours the water. Numerous vacuoles are present. The nucleus is large, oval or spherical, and there are one or more contractile vesicles. Longitudinal transverse self-division has been observed. They are found in stagnant water, especially where *Conferve* and *Oscillatoria* are present. Levick, Vice-president of our local Society has favoured ^{me} with the specimens I send.

W. Bolton, 17 Ann St Birmingham July 10 1879

Nassula ornata. Ehr.



H E Ferrest del

Plate IV.



Dr. Sars & Nord. del.

Marine Infusoria.

Marine Infusoria.

- Fig. 1.- *Dictyocysta cassis*, empty silicious lorica, showing fenestrated pattern. Fig. 2.- ditto, animalcule with extended tentacula; the fenestrae of the lorica are not represented, in order to give a clear view of the occupant (after Hackel). Fig. 3.- *Tintinnus subulatus*. Fig. 4.- *Ceratum fusus*. Fig. 5.- *Zoothamnium alternans*, showing at a, a, the larger and anillary reproductive zooids. Fig. 6.- ditto *dichotomum*, showing at a, the larger transversely striate reproductive zooids. Fig. 7.- *Follicularia ampullacea*, animalcule extended and inhabiting a lorica, with a moderately-produced neck. Fig. 8.- ditto, empty lorica, with very short neck. Fig. 9.- ditto, lorica with greatly produced neck, exhibiting annular growth markings; *Lagotis producta*. Fig. 10.- *Hemiphysa gemmipara*, with tentacles of all orders fully extended. Fig. 11.- ditto, with two anterior developed buds. Fig. 12.- *Ophryodendron pedicellatum*, proboscidiiform zooid, with characteristic organ extended. Fig. 13.- ditto, with proboscis retracted. Fig. 14.- ditto vermiform. Fig. 15.- *Ophryodendron multicapitatum*, sessile zooid, with proboscidiiform appendages. Fig. 16.- ditto, stalked zooid, 2 proboscidiiform organs, one immaturely developed, a form zooid, and two supplementary spheroidal buds. Fig. 17.- *Asterionella Bleakleyi* (?) showing characteristic disposition of the associated frustules. Fig. 18.- ditto, a detached frustule, exhibiting a substellate disposition. Fig. 19.- ditto, single frustule.

Of these Infusoria drawn by Mr. W. Saville in illustration of his paper in the Midland Naturalist on the Marine Excursion to Falmouth by the Birmingham Natural History Society. J.B. has sent to his subscribers *Zoothamnium dichotomum*, and *Follicularia ampullacea*.
Thos. Bolton, 57 Newhall St. Birmingham.

Bursaria truncatella.

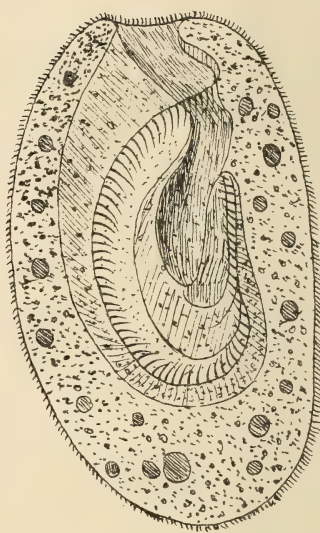
Genus Bursaria.— Surface ciliated throughout; anterior part convex; mouth not terminal, fringed with stronger cilia, though simple, toothless, and devoid of tremulous flap. The cilia are distinctly seen in coloured water, and are generally disposed in rows; those around the mouth are longer than the others. The nutritive system (says Ehrenberg) consists of an alimentary canal, curved forwards; it is furnished with digestive cells resembling little purses, which are attached to it by short stalks. The mouth is large, situated, as in *Leucophrys*, obliquely at the anterior extremity, so that a brow, as it were, either projects over it or else forms the end. The contractile vesicle is sometimes doubled; the nucleus oval or ovoid. The anus is placed at the posterior extremity. Self-division, longitudinal or transverse, has been observed in five species.

Bursaria truncatella.— The truncated *Bursaria*, large, visible to the naked eye; white, ovate, turgid, truncated and broadly excavated in front, where there is a simple row of cilia. In some specimens, Ehrenberg saw half-digested *Rotifera* and large quantities of vegetable matter in the nutritive cells, and was able, as he thought, by means of carmine given as food, to trace an alimentary canal through the greater part of its course. In each vacuole the food appears surrounded by a clear fluid, which Ehrenberg calls bile. A large bright vesicle is seen below the mouth and somewhat to the left of it, on which side is also a large curved but not articulated nucleus, reaching to the brow or frontal region. In ditches and ponds amongst rotten beech leaves. 1-45 to 1-36.

Pritchard's Infusoria.

57, Newhall St.

Thomas Bolton ~~of~~ Birmingham Jan^y 4th 1851.



Bursaria truncatella

Choano-Flagellata. S.K.

I this day send to my subscribers some leaflets of *Myriophyllum spicatum* encrusted with microscopical life both vegetable & animal. I have selected this weed because the student cannot examine a bit of it without detecting, besides other organisms, several species of the Choano-Flagellata so finely figured in the first part of W Saville Kents *Manual of the Infusoria*.

Being uncertain as to the species of one specimen, I sent a bit of the weed to W. Kent who has kindly forwarded me the pen & ink sketch on the other side, with the references and explanations given below.

The best way of examining it is to place a leaflet on a glass slide cover with thin glass or talc and examine with the highest power at command, the sketch is drawn with a power of about 700 diameters.

Explanation of Sketch

Centre figure. *Vaginicola valvata*

on *Myriophyllum spicatum*

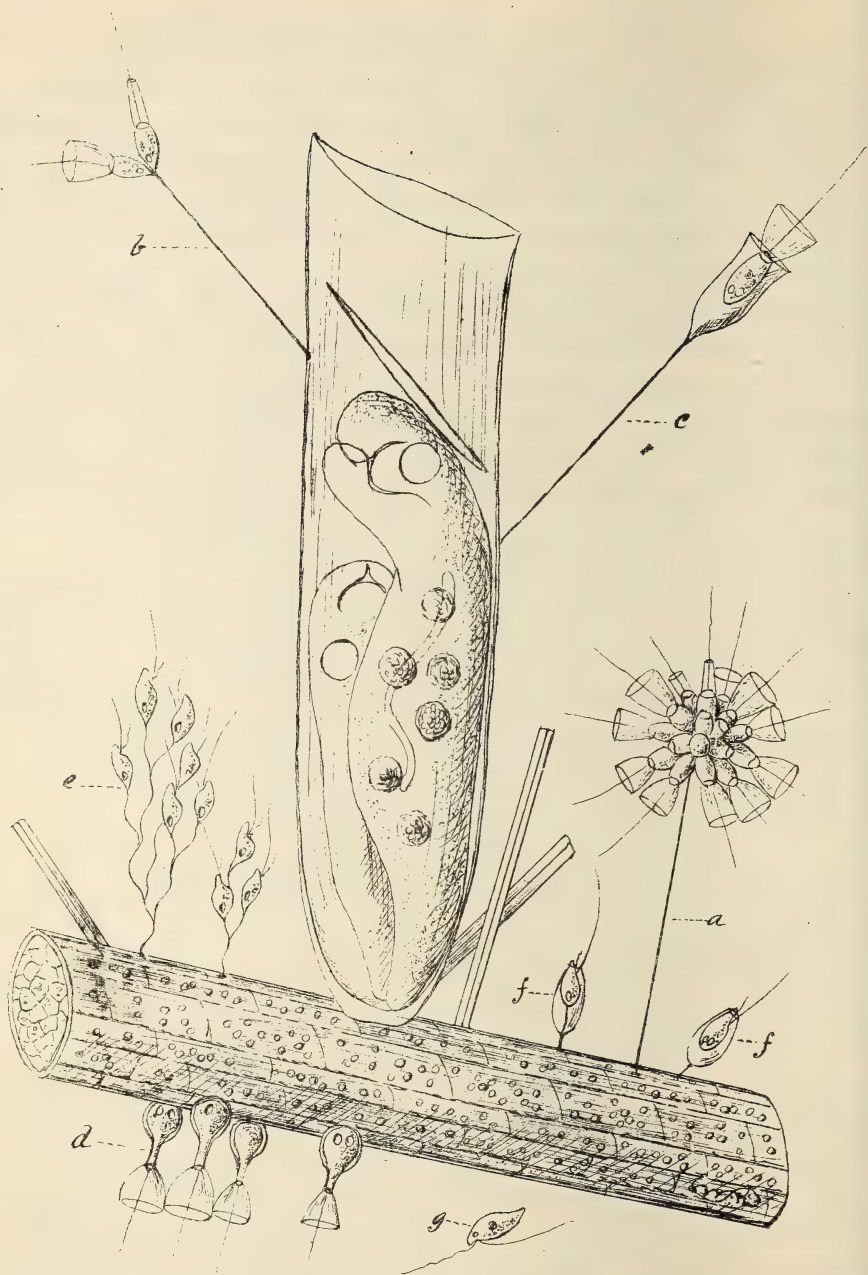
- Codosiga bobrythii* Pl II fig 22-29 Pl 6-10 (*Manual of Inf.*)
- Early growth of same species.
- Salpingoeca Boltoni*. S.K. newly discovered species.
- Salpingoeca amphoridium* Pl V fig 1-9.
- Cladonoma laxa*. S.K. Pl XVII fig 5-7.

also as *Anthophya laxa* Monthly Nov Journal Dec 1887

ff. *Bicosaca lacustris*. J. A. Clark. Pl XVIII fig 13-19

g. *Heteronima candata*. Pl XXIV fig 1-10

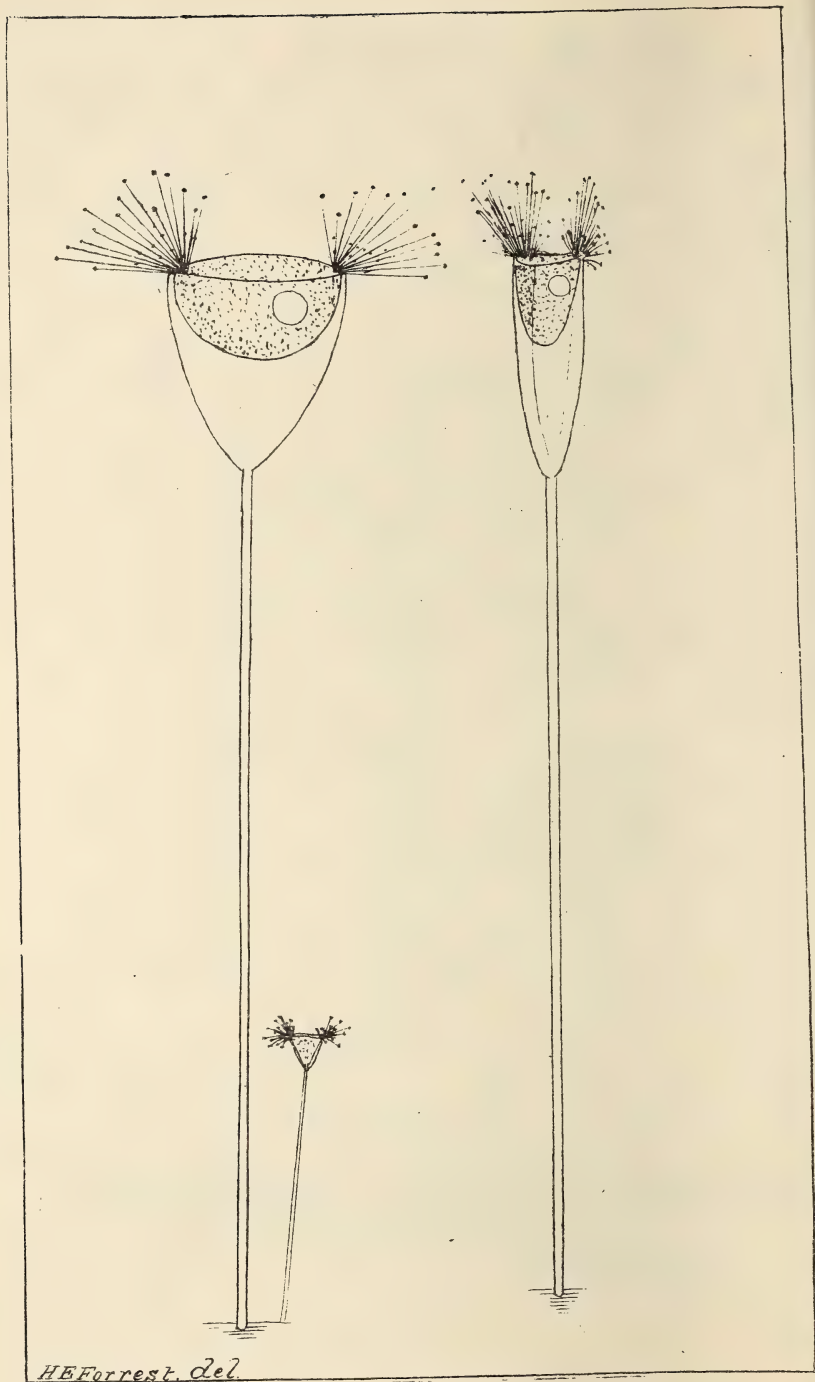
W Kent found all the above species on this bit of weed I sent him and also *Anthophya vegetans* Thomas Bolton 17 Ann S. Birmingham Nov. 5 1880



Acineta mystacina.

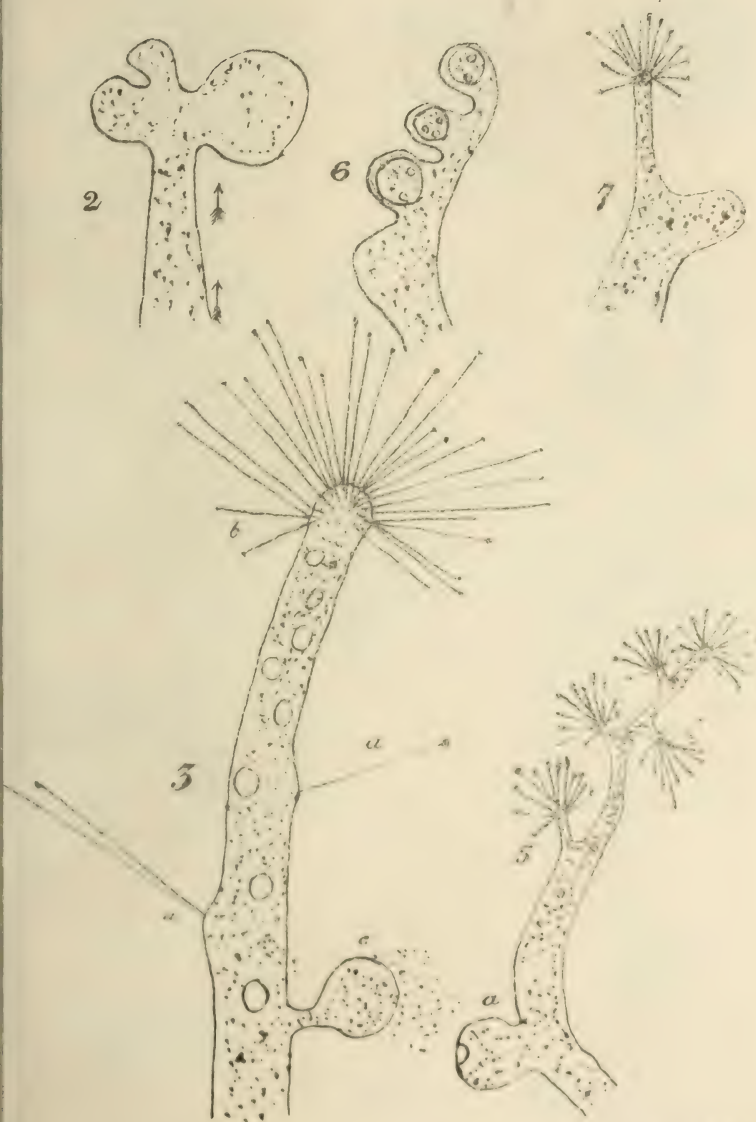
Rhizopoda, from which the two larger
ures on the other side, one laterally and
other nearly edgewise where drawn under
magnifying power of 300, must I think
the *Acineta mystacina* although when I
t it out to my subscribers on the 12th of
ember 1880 I felt some doubt about its
ntity on account of its unusually large
e. I found it very abundant on some
acharis albastrum and it was accompanied
numerous specimens of *Acineta tuberosa*
(smaller figure) and various species of
ticella.

Thomas Bolton, 57, Newhall St. Birmingham



H. E. Forrest. Del.

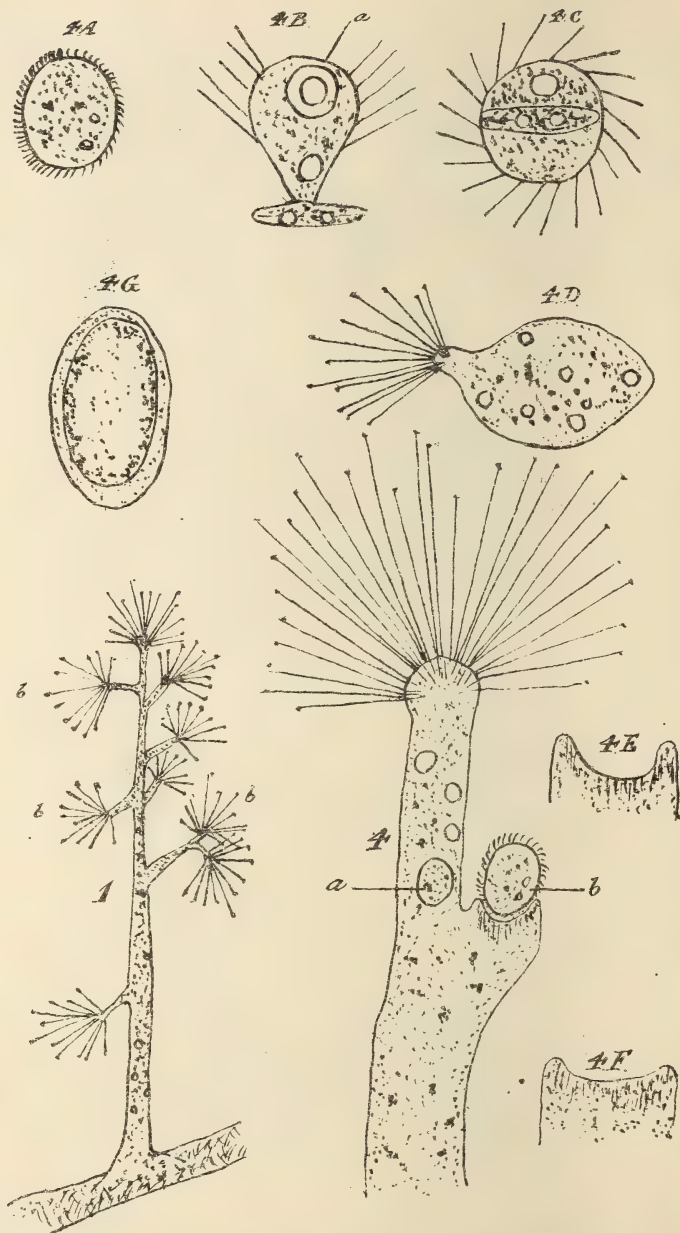
Plate 1.



Dr. H. C. Clark

Dendrosoma radians

Plate II.



after J. Levick.

Dendrosoma radians.

Dendrosoma Radians.

This interesting organism illustrated by the pen of M^r. J. Levick in the accompanying plate 18 II for the Midland Naturalist of Feb^r 1880 in which he gives a long description of its life history. This organism is nowhere else figured in any English publication

References to Plates.

- Fig. 1.- *Dendrosoma*, a fine specimen, $\times 50$ diameters.
" 2 " moving as an *Amoeba*, $\times 100$ diameters.
" 3 " with testes and early stages of the tentaculated heads, $\times 220$ diameters.
" 4 " showing embryos, $\times 220$ diameters.
" 5 " showing ovary, $\times 100$ diameters.
" 6 " a much contracted form, with three probable embryos, $\times 220$ diameters.
" 7 " supposed further stage of the series, 4A--4D, $\times 220$ diameters.

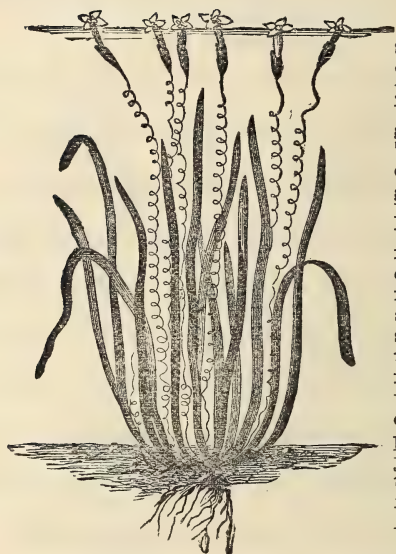
Figs E and F.- Part of Fig. 4, showing gradual return of the parent to normal form, $\times 440$ diameters.

Fig. G.- Probable egg, $\times 440$ diameters

Thomas Bolton, 57 Newhall St. Birmingham.

VALLISNERIA SPIRALIS.

Price 1s.



"This plant, a native of southern Europe, is undoubtedly one of the best and most copious yielders of oxygen of all fresh-water species, and therefore is of great service in small aquaria. The grass-like leaves show the circulation of the protoplasmic granules under the microscope, like the blood corpuscles in the web of a frog's foot. This plant roots freely in a little sandy earth or mud. The male and female flowers are borne separately, the latter having the long spiral stalks which have given to the plant its specific name. These float on the surface of the water; whilst the male flowers are borne on short stalks at the base of the plant. They are detached thence just before opening, and rise to the surface to fertilise the female flowers with their pollen.—*The Aquarium*, by J. E. Taylor.

"To examine the circulation, a thin section or shaving of a leaf should be taken with a sharp knife, so that the section chiefly consists of the superficial layer of cells. These will be found to be small, and the particles of Chlorophyll, though in great abundance, will rarely be seen in motion. This layer should therefore be sliced off, (or, perhaps still better, scraped away,) so as to bring into view the deeper layer, some of them greatly elongated, with particles of Chlorophyll in smaller number, but carried along in active rotation by the current of protoplasm; and it will often be noticed that the rotation takes place in contiguous cells, in opposite directions. If the movement (as is generally the case) be checked by the shock of the operation, it will be revived again by a little warmth; and it may continue, under favourable circumstances, in the separate fragment, for a period of weeks, or even of months.—*Carpenter on the Microscope*.



T. BOLTON,

BIRMINGHAM.

Lygnema cruciata.

Lygnema. A genus of Lygnemaceae (Conferoid
Algae), consisting of filamentous plants, with
green contents of the cells arranged in twin
ellate or lobed masses in each joint. This
stellate appearance arises from the presence of
radiating threads, like those from the nucleus
of Spirogyra; hence it cannot be well observed
in dried specimens. Cell-division with previous
division of the stellate masses may be well studied
in this genus. Kützting separates from this genus
all the forms in which the spore is formed in the
off branch produced in conjugation, associating
them with Lygogonium. We prefer to follow Hap-
pelt's distribution of the forms, seeing that Lygogonium
ceterorum is a plant of very different appearance
to *cruciata*. Filaments 1600 in dia^m; joints equal
twice as long; spores globose. Micrographic Dictionary

This pretty Alga has been sent to me from Owens College,
and is longer than above stated. Although possibly
common enough I have never seen it before at least
to recognize it, so think it may be of interest to my
correspondents.

April 23rd 1880

Thomas Bolton, 17 Ann St Birmingham

Zygnema cruciata



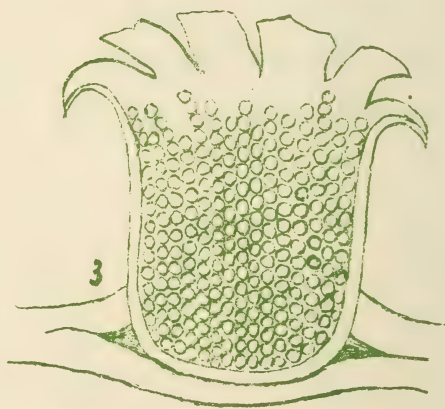
x 150 diam.

H. E. Forrest. del.

Aecidium urticae.

This pretty little fungus the golden Blister-cup of the nettle is described by M. C. Cooke in his *Microscopic fungi* as *Aecidium urticae*, Nettle Cluster-cups; spots bliterated, subiculum thickened; peridia disposed in elongated or subrotund heaps, at first subglobose, then gaping; spores orange. - On leaves and stems of Nettles, distorting them very much. Common. June." Figures 1 & 2 are copied from his plate Fig 3 an enlarged drawing of a single Cup of the *Aecidium compositarium* is copied from the *Micrographic Dictionary* in which a most elaborate description of the life history of this genus of fungi will be found. I have myself found the Nettle Blister-cup in one locality only but there it appears pretty abundantly annually. The *A. compositarium* seems to be pretty abundant everywhere on the leaves of the Colts-foot.

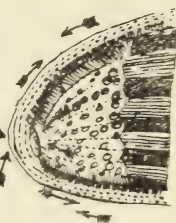
Thomas Bolton, 57, Newhall St. Birmingham.



Acidium Urlicæ

I send herewith a very clean gathering of Desmids and Diatoms from Sutton Park. Mr. Forrest has sketched seven species of the Desmids which ^{are} fairly abundant in the gathering. In this month's *Midland Naturalist* Mr. Hills gives a list of 97 species, or varieties of Desmidiaceae found in this locality.

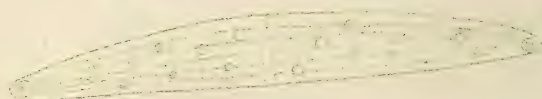
The so-called circulation or (Brownian Movement?) of granules in the protoplasm within the *Closterium lunula*. On the margin, I give a sketch shewing this circulation at the extremity of a filustrule, copied from "The Microscope" by Hogg, in which will be found a long account of it. "Did we trust solely to the eye, we should indeed be very liable to pronounce these variable and beautiful forms, as belonging to animals, rather than vegetables. All favours this supposition. Their symmetrical division into parts, the exquisite disc-form, finely cut and toothed *Microsterias*; the lobed *Euastrum*, glittering as it were with gems; the *Xanthidium*, armed with spines; the scimitar-shaped *Closterium*, embellished with striae; the *Desmidium*, resembling a tape-worm; and the strangely insect-like *Staurastrum*, sometimes furnished with arms, as if for the purpose of seizing its prey, - all these characteristics appear to a superficial observer to belong rather to the lowest forms of animal, than vegetable life. With this gathering, I have found some large *Amoeba*, and some few *Nardina*. Both these are evidently feeding on the Diatoms only. -



Nov. 15th 1880.

Thomas Bolton, 57, Newhall St. Birmingham

Clasterium lunata



Clasterium didymum



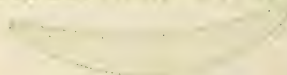
Eusira



Micrasterias denticulata



Clasterium striatum



Eusira didota



Temnodictyon punctatum



all x 100 dia

Thin glass Loophole Troughs 1/- each.
 Deal Box to hold six troughs 4/- each.
 Six Troughs assorted thicknesses in Wooden
 Box Post free 6/3.
 Botterills Life Slide Post free 2/8
 — " — Trough — " — 4/3
 Large Trough to hold Specimen Tubes 4/-
 Graham Compressorium Post free 10/6
 Wells' — " — " — " — 2/-
 Set of 2 Capillary tubes & small syringe in
 box Post free 1/6. Small glass syringe with
 piston and finger ring 6d.
 Worked glass tubes (empty) 1/- per dozen
 labelled. Postal Cases 1/- — " —
 Field collecting. Stick, with ring, bottle,
 hook, and netting. 14/-.
 Collecting bottle, with strainer 3/-.
 Microscope Lamp in box 12/6.
 Kent Top Revolving Microscope Table 35/-.
 Leather Covered Mahogany — " — " — 50/-.
 Profolius of Drawing Nos. 1, 2, 3 & 4 1/- each.
 Treatise on the Preservation of Living organism
 and their examination under the Microscope 3/-
 the Midland Naturalist 6/- per Annum.
 the Northern Microscopist 6/- — " —
 W. L. L. Kent's Manual of the Infusoria
 of each part (three parts published) to be
 completed in six parts.
 Kent's Eyepiece Reflector, for drawing
 with the Microscope, Post free 8d.
 Artificial Sea Water, mixed according to
 the formula in use at the Aston Aquarium
 Galton 2, 2 1/4, 3 1/2, 4 1/5, Price of plain Stone Bottle.
 " 1, 2 1/2, 3 3/4, 4 1/2, " Wickered
 " 1/3, 2 1/6, 3 3/6, 4 1/4, " Solution six times
 strength to which add 5 Gal. of River, or Town water
 to 1 Gal. of the Solution. Pair of G. G. Bulbs 2/-.
 Round Glass Aquarium 8 1/2 dia x 5 1/2 deep 2/6 each.
 Black Varnished Wooden Stands 2/6 each.

The Catalogue of David White (135 Queens) by G. B. Richter, on Board 3/6, Standard Width 4/-.
 400 lbs. Weight sample of place by W. J. Beck (cost 26.6.0) price 6/3.
 White Aquarium, glass front & loose sloping back 21" x 13" x 6" deep 40/- each.

A SIMPLE MODE OF AERATING SMALL MARINE AQUARIA.

[Reprinted from *Midland Naturalist* for November, 1880.]

Of the three modes of maintaining the water of an aquarium in good order, viz.—by vegetation; by circulation of the water; or by injecting air; the first generally fails to maintain the balance if the aquarium be at all crowded, whilst the second involves such expense as to generally prevent its adoption. The difficulty which has hitherto prevented the adoption of the injection of air has been the necessity of some mechanism for maintaining it continuously. I have, however, devised a plan which is simplicity itself, and can be constructed, for a few shillings, out of glass and india-rubber tubes. The principle is that known as the “Trompe.” A stream of water falls in drops down a tube about $\frac{1}{4}$ in. in diameter, and furnished with a funnel at the upper end. These drops of water falling down the tube carry air with them. The bottom end of the tube enters the top of a cylinder, from the top of which also issues the compressed air, by a tube, and is conveyed by a tube to the aquarium. From the bottom of the cylinder a tube conveys the water, and being bent upwards, discharges the water at a certain height above the bottom of the cylinder. When the apparatus is in working order, the vertical difference in height between the level of the water in the cylinder and the discharging orifice, is exactly equal to the depth at which the air-tube discharges the air into the aquarium. The aquarium being higher than the cylinder, it is impossible that the water used, which may of course be fresh water, should get into the aquarium. A 5ft. fall is sufficient to drive the air to a depth of 6in. in the aquarium, and, as I have found from experiment, six times the volume of water used, though this will, of course, vary according to the depth to which it is injected. In my own apparatus, one gallon of water will keep up a continuous stream of bubbles, rising through the aquarium for from two to four hours, keeping it perfectly clear and bright, and evidently delighting the animals. The small quantity of water used renders it practicable even where the water-works are not at command. It is only necessary to have two receptacles for the water, one above and the other below, and when the water has all run over into the lower one, to change them. In order to use a very slow current of water, it is advisable to insert, just below the funnel, a double syphon, which prevents air rising up the tube, and where the water collects until its accumulated force is sufficient to drive the air down the tube. This air injection may also be used to produce a circulation of the water at the same time as aerating it. Thus, let two vessels, A and B, be connected by a narrow tube below the water level, and let the tube terminate in A, by an inverted funnel. Then, if the discharge of bubbles take place underneath this funnel, they will rise through the tube and carry a certain quantity of water with them. A piece of glass tube bent into a syphon will convey the water back again into A. Any number of vessels can be interposed between B and A by syphons, and the current will be maintained through the whole. I shall be pleased to show the apparatus at work to anyone interested in the subject.—C. J. WATSON, 34, Smallbrook Street, Birmingham.

A CAMERA LUCIDA FOR EIGHTPENCE.

Mr. H. E. Forrest, F.R.M.S., has devised a small instrument simulating Dr. Beale's neutral tint reflector, for the purpose of sketching microscopic objects. Its price is sixpence, or post-free eightpence, and can be obtained from Mr. Thos. Bolton, 57, Newhall Street, Birmingham. During a recent visit to Birmingham, we gave this instrument a trial, and can confidently recommend it to our readers.—*Northern Microscopist*.

June, 1881.]

c+p.

[No. 5.]

PORTFOLIO OF DRAWINGS,

AND DESCRIPTIONS OF

LIVING ORGANISMS,

(ANIMAL AND VEGETABLE)

ILLUSTRATIVE OF

FRESHWATER AND MARINE LIFE,

WHICH HAVE BEEN SENT OUT WITH THE LIVING SPECIMENS BY

THOMAS BOLTON, F.R.M.S.,

57, NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING.

CONTENTS.

VEGETABLE KINGDOM.

Protococcus pluvialis.	Batrachospermum monili-
Vaucheria.	forme.
Freshwater algæ.	

ANIMAL KINGDOM.

Ophrydium longipes.	Pterodina clypeata.
Stentor polymorphus.	Gammarus pulex.
Trichodina pediculus.	Caprella lobata.
Clava squamata.	Alcyonidium polyoum.
Syncoryne frutescens.	Bowerbankia imbricata.
Anguillula glutinis.	Triticella pedicellata.
	Pedicellina cernua.

LONDON: DAVID BOGUE, 3, ST. MARTIN'S PLACE, W.C.

LIST OF ORGANISMS ALREADY SENT TO SUBSCRIBERS.

1878.

- Sep. 13. *Lacinularia socialis*
 " 20. *Cristatella mucedo*
 " 27. *Limnias ceratophylli*, with *Melicerta ringens*
 Oct. 4. *Stephanoceros Eichornii*
 " 11. *Plumatella repens*
 " 18. *Stentor polymorphus*
 " 25. *Philodina roseola*
 Nov. 1. *Closterium lunula*
 " 8. *Spongilla fluviatilis*
 " 15. *Floscularia campanulata*
 " 22. " *cornuta*
 " 26. *Hydatina senta*
 Dec. 6. Larval Form (Trochosphere) of Marine Polyzoa (*Alcyonidium*)
 " 13. Marine Polyzoa
 " 20. *Raphidiophrys pallida*
 " 27. *Volvox globator*

1879.

- Jan. 3. *Euglena viridis*
 " 10. *Loxophyllum meleagris*
 " 17. Spawn of Trout
 " 24. *Ocistes crystallinus*
 " 31. Infusoria
 Feb. 7. *Ocistes*, with other Rotifers
 " 14. Young Trout, (Aleven stage)
 " 21. *Spirostomum ambiguum*
 " 28. *Rhinops vitrea*
 Mar. 7. *Euglena* and *Hydatina*
 " 14. *Plumatella repens*
 " 21. *Spongilla fluviatilis*
 " 28. *Cristatella mucedo*
 April 4. *Synchaeta pectinata*
 " 11. Embryo of Mussel
 " 18. *Nitella translucens*, with *Carchesium polypinum*
 " 25. *Batrachospermum moniliforme*
 May 2. Elver (young Eel)
 " 9. Spawn of Perch
 " 16. *Pandorina morum*
 " 23. *Fredericella sultana*
 " 30. *Brachionus pala*
 June 6. *Uroglana volvox*
 " 13. Larva of *Corethra plumicornis*
 " 20. *Asplanchna Brightwellii*
 " 27. Floscules
 July 4. *Gonium pectorale*
 " 11. Marine objects (various)
 " 18. *Nostoc commune*
 " 25. *Volvox* and *Plumatella*
 Aug. 1. *Leptodora hyalina*
 " 8. *Hyalodaphnia Kahlbergensis*
 " 15. *Kondylostoma patens*
 " 22. *Vaucheria*
 " 29. *Conochilus volvox*
 Sep. 5. *Brachionus urceolaris*
 " 12. *Sida crystallina*
 " 19. *Lacinularia socialis*
 " 26. *Vorticellidae*
 Oct. 3. *Stentor Mulleri*
 " 10. *Diaptomus castor*
 " 17. *Hydra vulgaris*
 " 24. *Bosmina longirostris*
 " 31. Rotifers (various)
 Nov. 7. Weeds incrustated with Rotifers and Infusoria
 " 14. *Ophrydium versatile*
 " 21. *Hydractinia utriculatum*
 " 28. *Peridinium tabulatum*
 Dec. 5. *Draparnaldia glomerata*
 " 12. *Stentor Barretti*
 " 19. *Lophopus crystallinus*
 " 26. *Spirorbis nautiloides*

1880.

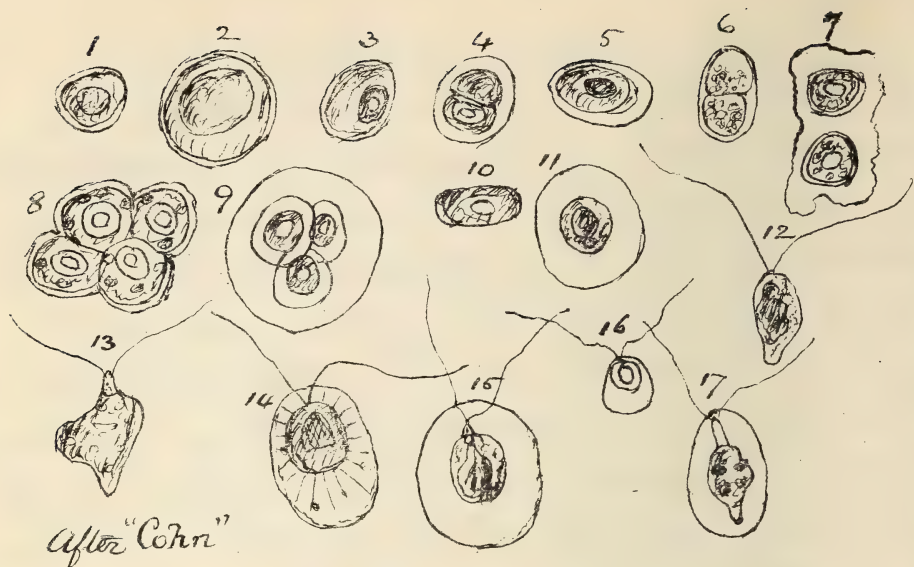
- Jan. 2. *Canthocamptus furcatus*
 " 9. Zoëa of Crab
 " 16. Spawn of Trout
 " 23. *Acineta mystacina*
 " 30. *Urostyla grandis*
 Feb. 6. Spawn of Char
 " 13. *Synchaeta tremula*
 " 20. *Zoothamnium*
 " 27. *Rhinops vitrea*
 Mar. 5. *Coleps hirtus*
 " 12. *Nitella Embryo*
 " 19. *Dinobryon sertularia*
 " 26. Glass Larva
 April 2. *Chaetophora elegans*
 " 9. *Asplanchna Brightwellii*
 " 16. Spawn of Perch
 " 23. *Zygnema cruciata*
 " 30. *Brachionus* on *Daphnia*
 May 7. Elver or young Eel
 " 14. *Conochilus volvox*
 " 21. Larval Shrimp
 " 28. *Bosmina longirostris*
 June 4. *Melicerta ringens*
 " 11. *Anuræa longispina*
 " 18. *Hyalodaphnia Kahlbergensis*
 " 25. *Leptodora hyalina*
 July 2. *Vorticella chlorostigma*
 " 9. *Paludicella Ehrenbergi*
 " 9. *Nais proboscidea*
 " 23. *Spirulina oscillarioides*
 " 30. *Protococcus pluvialis*
 Aug. 6. *Alcyonella fungosa*
 " 13. *Argulus foliaceus*
 " 20. *Edogonium ciliatum*
 " 27. *Epistylis plicatilis*
 Sep. 3. *Daphnia pulex*
 " 10. *Bugula avicularia*
 " 17. *Nassula ornata*
 " 24. *Clava squamata*
 Oct. 1. *Melicerta* and *Floscules*
 " 8. *Cordylophora lacustris*
 " 15. *Colpidium cucullus*
 " 22. *Pedicellina cernua*
 " 29. Rotifers (various)
 Nov. 5. *Choano-flagellata*
 " 12. *Acineta mystacina*
 " 19. Trochospheres of Polyzoa
 " 26. Desmids and Diatoms
 Dec. 3. *Spirostomum teres*
 " 10. *Distigma proteus*
 " 17. *Asellus vulgaris*
 " 23. Ova of *Salmo fontinalis*
 " 31. *Follicularia ampulla*

1881.

- Jan. 7. *Bursaria truncatella*
 " 14. *Pterodina clypeata*
 " 21. *Spirorbis nautiloides*
 " 28. *Argulus foliaceus*
 Feb. 4. *Anguillula glutinis*
 " 11. *Opercularia nutans*
 " 18. Trout Fry
 " 25. Glochidia (spawn of Mussel)
 Mar. 4. *Batrachospermum moniliforme*
 " 11. *Paramecia aurelia*
 " 18. Salmon Fry
 " 25. *Bowerbankia imbricata*
 April 1. Rotifers (free swimming)
 " 8. *Stentor polymorphus*
 " 14. *Trichodina pediculus*
 " 22. *Gammarus pulex*
 " 29. Elver (young Eel)
 May 6. *Actinosphaerium Eichenorii*
 " 13. *Cercaria* (Larva of Fluke)
 " 20. *Spirogyra* in conjugation

The moving cell of *Protoroccus* is composed of two principal parts - a hyaline spherical envelope, formed of a delicate structureless membrane consisting of cellulose, which immediately surrounds the colourless contents, consisting, perhaps, of pure water. In the centre of the envelope occurs a coloured globule composed of the universal nitrogenous protoplasm or mucus of vegetable cells, coloured red or green by a carmine red oil or chlorophyll, and containing in it numerous granules of protoplasm, as well as one or more chlorophyll vesicles. This coloured globule is attenuated at the upper end into a colourless point; from this point go out two cilia, which protrude into the water through two orifices in the membrane of the envelope, and produce the movements of the whole organism. The inner coloured globule is not bounded by any rigid membrane, but merely by a thickened layer of protoplasm; hence its contour is very changeable and passes through manifold transformations in the course of its development.

Thomas Bolton, 14 Ann St. Birmingham. July 30th 1890.



Protozoococcus pluviialis

- Fig. 1. — A small "stall" cell revived after desiccation.
2. — A very large cell, in which the red, finely granular contents, fill up the membrane.
3. — A green cell containing an eccentric red nucleus.
4. — A cell undergoing segmentation.
5. — A cell which has assumed an elliptical figure preparatory to its dividing.
6. to 11. Various stages of division and development.
12. — A large naked zoospore, green, with red central substance, and a colourless spot at the anterior end, with two vibratile cilia.
14. — An encysted zoospore, with filaments of protoplasm, a distant "enveloping cell," two cilia.
15. — An encysted zoospore, with distant "enveloping cell," green, gelatinous, primordial cell; red, granular, disseminated central substance, and a colourless point.
16. — A very small, globular, encysted zoospore.
17. — An encysted zoospore, pointed at both ends, altogether green.

Vaucheria (germinating gonidia),
An important and to the microscopist a
most interesting genus of Siphonaceae
(Conferoid Algae), consisting of green filamen-
tous plants growing in fresh and salt water,
and on damp ground, characterized by the
continuity of the cavity throughout the branched
tubular filament (sometimes several inches
long) of which each plant is composed,
and by the modes of reproduction, both by
gonidia and by spores. *Vaucheriae* may
be gathered on damp borders in every garden,
or by the sides of ditches, where they form fine
silky green tufts; they are very variable in
form and size, so that the specific distinctions
heretofore laid down appear to be worth little.
The ordinarily occurring species presents
itself as a tubular cell of comparatively
gigantic dimensions, containing more or
less protoplasm, coloured by chlorophyll in
the form of minute granules applied upon
the wall or occupying more or less of the
cavity. A full description will be found in
the Micrographic Dictionary, and Carpenter's
Revelation of the Microscope.

Thos Bolton, 57, Nicholl St. Birmingham.



FRESHWATER ALGÆ.

Extracts from a Paper by A. W. WILLS in the Midland Naturalist, 1878.

The last great family which remains to be noticed is that of *Conjugatæ* or *Zygnemaceæ*. These plants consist essentially of transparent elongated cells, placed end to end in long filaments, and containing in their interior masses of endochrome variously arranged; in *Zygnema* disposed in twin stellate radiating forms; in *Spirogyra* in one or more spiral bands running round the walls and presenting at intervals bright points, usually consisting of starch-globules; the whole forming objects of singular elegance and beauty. In all the genera belonging to this large family, but especially in the two just named, the phenomena of cell-division may be readily observed, (taking place through a nucleus usually suspended in the centre of the cell, and often very conspicuous,) and as all the cells of an individual filament frequently undergo simultaneous reduplication in this manner, its growth is enormously rapid.

Conjugation, as the term implies, consists of the yoking together of two contiguous filaments which, by some mysterious means, approach one another and assume a position of strict parallelism. Projections are then thrown out between opposite pairs of cells and gradually increase till they finally meet and form connecting tubes. At the same time the endochrome loses its spiral arrangement, and becomes an irregular, confused mass. [Plate III., Fig. 14.] It then passes, as in *Zygnema* [Plate III., Fig. 12] and *Spirogyra*, [Figs. 13, 14,] into the opposite cell and there, mingling with the contents of the latter, forms a round or oval spore with distinct cellulose coating; or, as in *Mesocarpus* [Fig. 15] and *Staurocarpus*, [Fig. 16,] meets the contents of the opposite cell, which move forward to join it, in the connecting tube, and there forms a spherical or cruciate spore. A curious modification of this process occurs in some species of *Spirogyra*, where the spores are formed not from the contents of two opposite cells of different filaments, but by the union of those two contiguous cells of the same filament, the mingling of which is effected through a little tube bridging over, as it were, the septum between them. [Plate III., Figs. 17, 18.] It is asserted by some writers that this phenomenon is abnormal, and occurs in species which usually conjugate in the ordinary way; but the writer has only once seen the two processes occurring simultaneously in the same plant, and has always observed this form of conjugation in specimens the proportions of which stamp them as distinct species. The most striking point about the operation just described is the assumption by the contents of the cells of *different* plants, or by those of *special* cells in the *same individual*, of the opposite properties up on which depend respectively the powers of *imparting and receiving* [fertilisation, although the most careful scrutiny under the highest powers of the microscope fails to reveal the least difference in their condition. It has been stated that this polarisation, as it may fitly be termed, in the ordinary form of conjugation, is capricious, the cells of the two filaments assuming indiscriminately these converse functions, but in the many hundreds of specimens which we have examined and mounted, we only remember finding one exception to the rule that all the cells of one conjugating filaments assume "male" and those of the other "female" sexual functions; this exception occurred in the specimen already referred to, in which conjugation of contiguous cells of the same individual also took place, and in this case the spores formed in one filament were large, while those in the other and alongside of the cells which had discharged their contents were much smaller, and apparently imperfectly developed.

DESCRIPTION OF FIGURES IN PLATE

Fig. 12.—*Zygnema lutescens* in conjugation.

Fig. 13.—*Spirogyra inflatum* in conjugation.

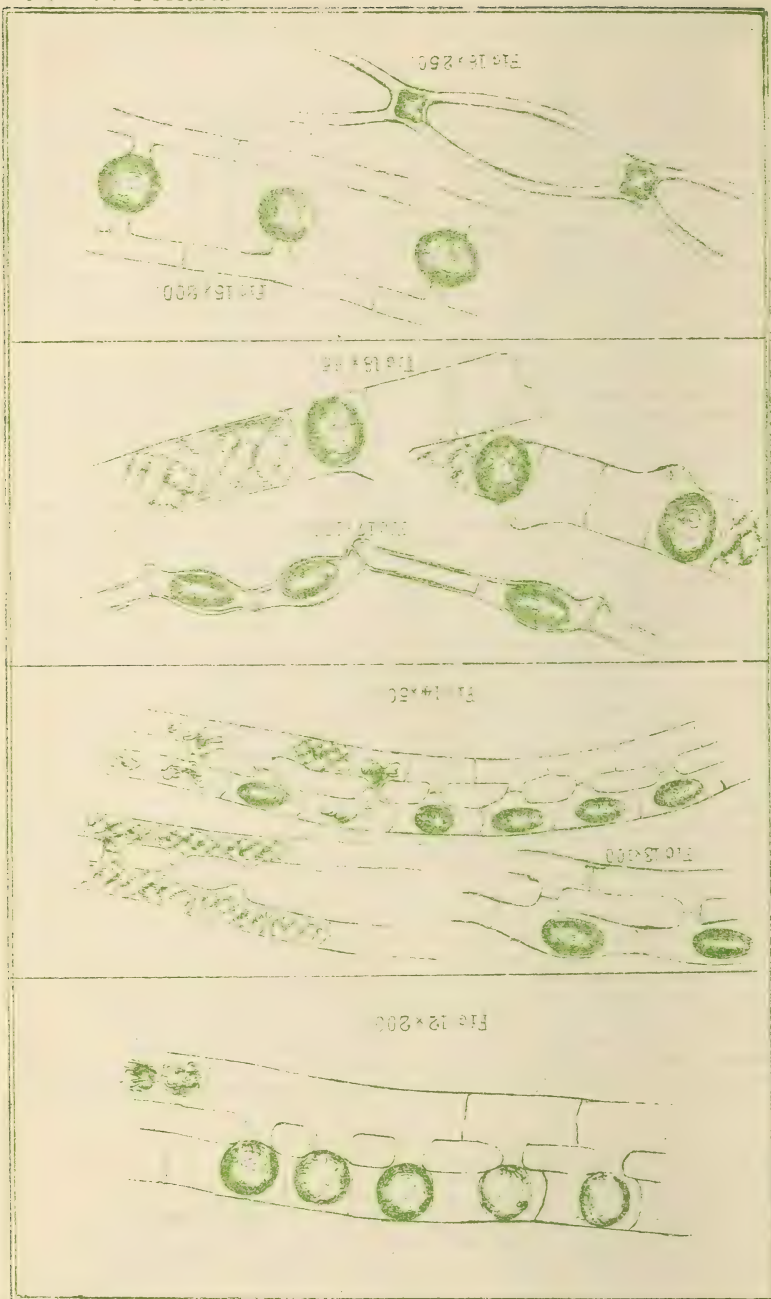
Fig. 14.—*Spirogyra neglecta*, showing various stages of conjugation.

Fig. 15.—*Mesocarpus scalaris*, showing formation of spores in connecting tubes.

Fig. 16.—*Staurocarpus gracilis* in conjugation.

Fig. 17.—*Spirogyra angularis*, showing formation of spores from contents of contiguous cells in one filament.

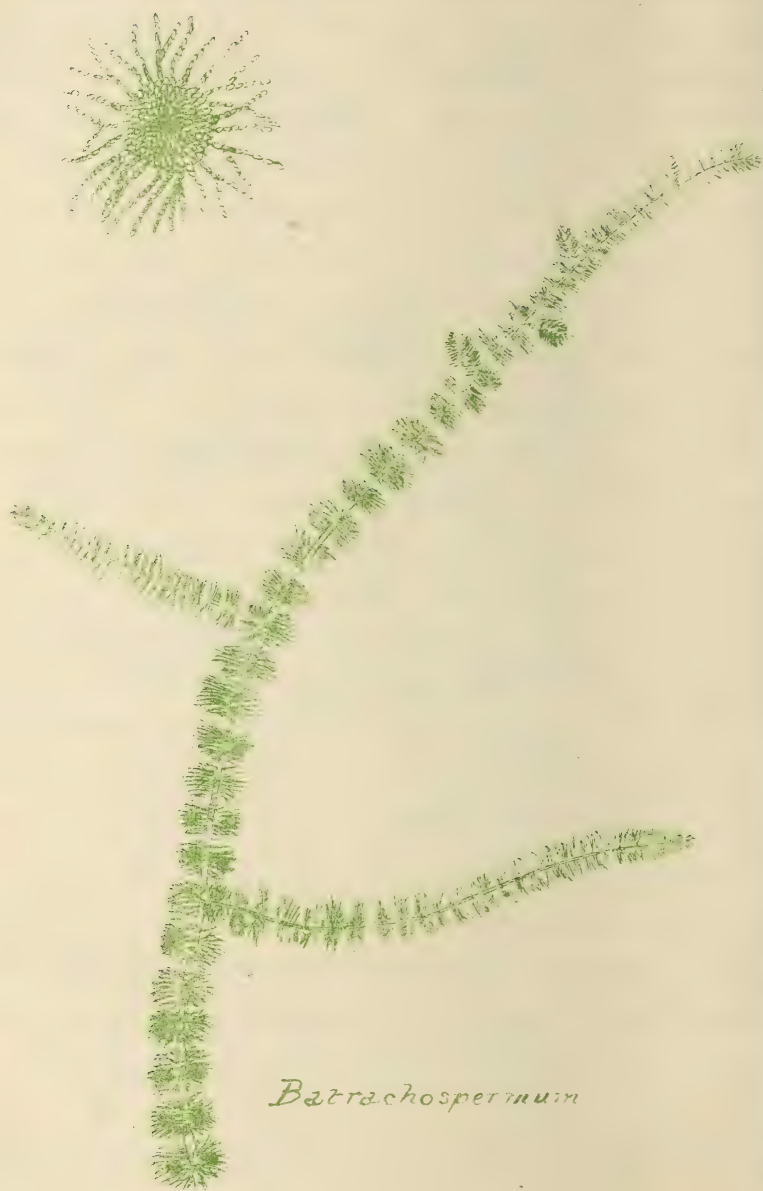
Fig. 18.—*Spirogyra woodsi*, showing formation of spores from contents of contiguous cells in one filament.



Batrachospermum moniliforme

named from the strong resemblance which the beaded filaments, when out of the water, bear to frog spawn. It exhibits a somewhat greater complexity of structure, and affords objects of extreme beauty to the Microscopist. I give below description taken from Hassall's British Freshwater Algae. Char.: Algae gelatinous, moniliform, sessile, articulated, verticillate, filaments of the verticilli dense, dichotomous, and beaded; the inferior ones simple, descending, and forming a sheath around the primary cells. Reproduction consisting of glomerules scattered throughout the verticilli, to which they are attached by a single filament or thread. Flavour blackish-brown. Whorls of the stems distinct, spherical, the branches confused. The Batrachosperms are highly flexible and mucous to the touch, their lubricity arising in a measure from the presence of innumerable lashes or cilia terminating the branches which add also infinitely to the microscopical beauty of these productions. Each column is articulated in a manner similar to that of the branches, which they may be regarded as extensions.

Thos Bolton, 57, Newhall St Birmingham Mar 4th 1887



Batrachospermum

H.E. Forrest, del.

Ophrydium longipes.

This *Ophrydium*, which I found first some eight years ago, differs from the *O. versatile* in the absence of the green chlorophyll and the clusters are much smaller, usually about the size of a pins head, of a hemispherical shape, and always attached to some weed or alga often as shewn in sketch placed on a leaf of *Anacharis*.

Mr. W. Saville Kent gave it the name of *O. longipes* from the pedicle by which the individuals are connected. These pedicles are easily seen in the younger specimens but either disappear or are more difficult to discover in older specimens. Mr. Kent tells me that he has now proved that the individuals of which the *O. versatile* consist are connected together by a system of branching pedicles.

Thos Bolton 57, Newhall St. Birmingham.



Ophrydium longipes.

Trichodona pediculus.

A Vorticellina destitute both of tail and pedicle, distinguished from Stentors by the surface of the body being destitute of Cilia; they possess a vibrating fasciculus or wreath of Cilia anteriorly; the oral opening is simple and not spiral.

They are found parasitic or rather commensal upon Hydra, looking like little pork-pie hats or rather when fully extended like dumpy dice-boxes.

The base is surrounded with a wreath of hooks or curved setae and by their action they appear to hold on to the surface of the Hydra and occasionally rapidly glide over the body and up and down the tentacles regardless of its formidable poison glands.

April 14th 1881.

Chas. Bolton, 57 Newhall St. Birmingham.

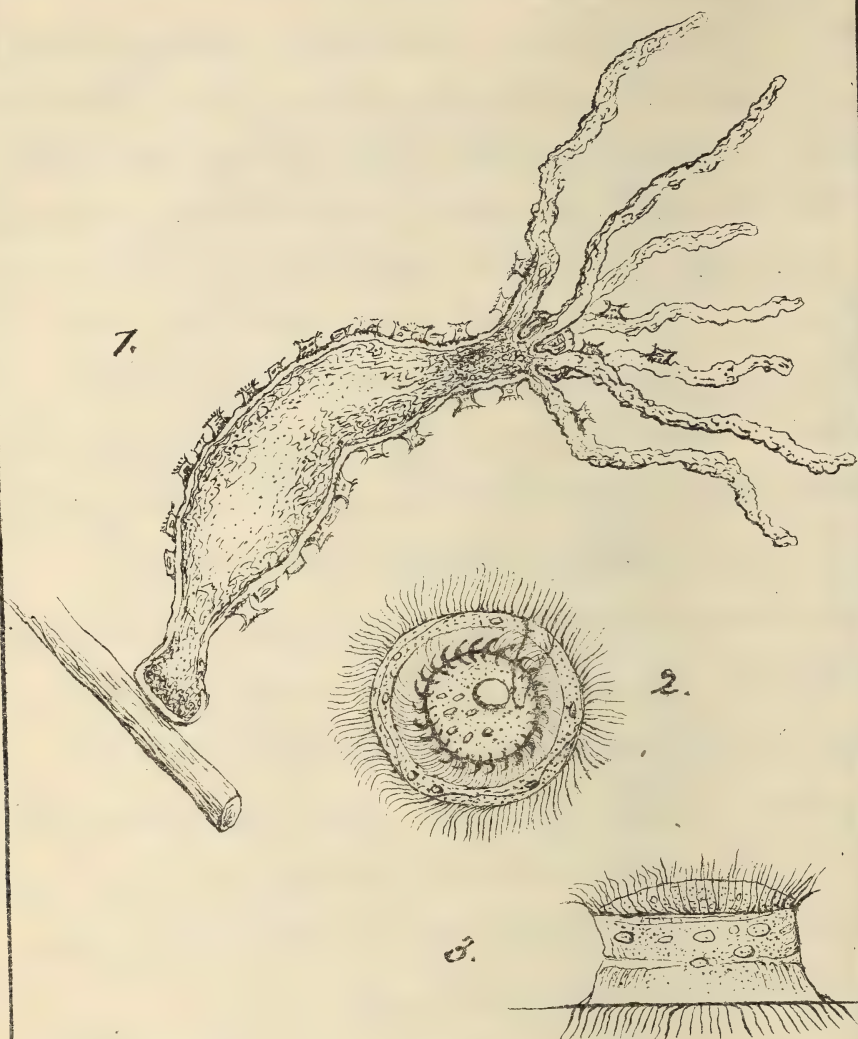


Fig 1. *Hydra vulgaris* infested with
Trichodina pediculus. X 40.
 Fig 2. *T. pediculus* viewed from beneath X 400.
 Fig 3. do side view. X 400.

Stentor polymorphus.

These beautiful green Trumpet-animalcules owe
their exquisite tint to numberless green vesicles, or
all cavities filled with colouring matter (Chlorophyll,
that of plants. They possess a marvelous power of
changing their shape. In size this Stentor varies from
hundred and twentieth to one twenty-fourth of an inch.
entirely covered with fine cilia, disposed in longi-
tudinal rows, and round the head is a spiral wreath
larger and very conspicuous cilia leading to the
mouth. Having observed the abundance of these creatures,
in small branches to which they were appended, were
placed in the glass trough, and viewed with powers of sixty
to one hundred linear. Some had tumbled down to
helmet-like lumps, others presented broad funnel-shaped
heads, while others stretched themselves to great length
like the long, narrow post-horns which still wake the
echoes of a few old-fashioned towns. The ciliary motion
of the elegant wreath was active and rapid, causing
it to stir among all the little particles, alive
and dead; and when the right sort of food came
near the corkscrew entrance to the mouth, down
went, and if conspicuous for colour, was subse-
quently seen apparently embedded in little cavities,
which Ehrenberg supposed were separate stomachs,
though that theory is now seldom received. One
advantage of viewing these objects in a sufficient
quantity of water, to leave them in freedom, is
that they frequently turn themselves, so that you can
right down into them."

Stentor's Normals of Pond Life.
(price 36)

Boston, 57 Newhall St. Birmingham, April 6, 1871

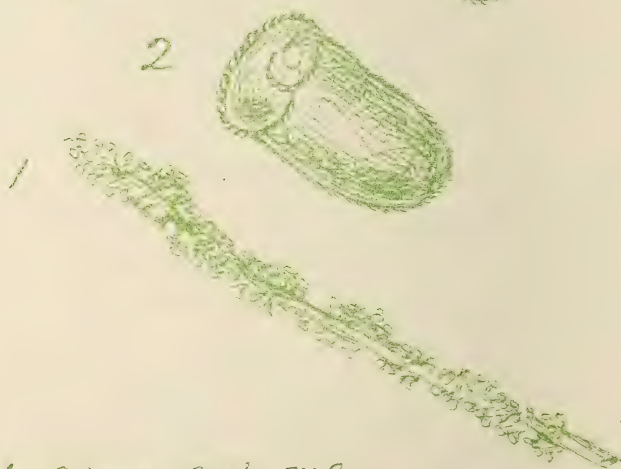


Fig 1. Colony nat. size.

2. Individual swimming. x 50

3. Attached Colony. x 50.

Stentor Polymorphus

Syncoryne frutescens.

The beautiful *Hydrozoa* figured in the accompanying drawing I believe to be the above named species, although at first sight I took it to be the common species *Ieximia*. It is now abundant on the walls of the reserve tanks of the Aston Aquarium, and I have lately taken several specimens with the Medusa-form Gonosome just on the point of leaving the "Hydranth" and commencing its wandering life.

Professor Allman in his *Tubularian Hydroids* says he has only seen this species once, and gives October as the season for the development of the Gonosome.

He describes it as follows, "Trophosome. - Hydrocaulus much branched, rising from a creeping stolon, and attaining a height of from one to two inches; perisarc smooth. Hydranths oval, with about 14 tentacles."

Thos. Bolton, 57, Newhall St. Birmingham.

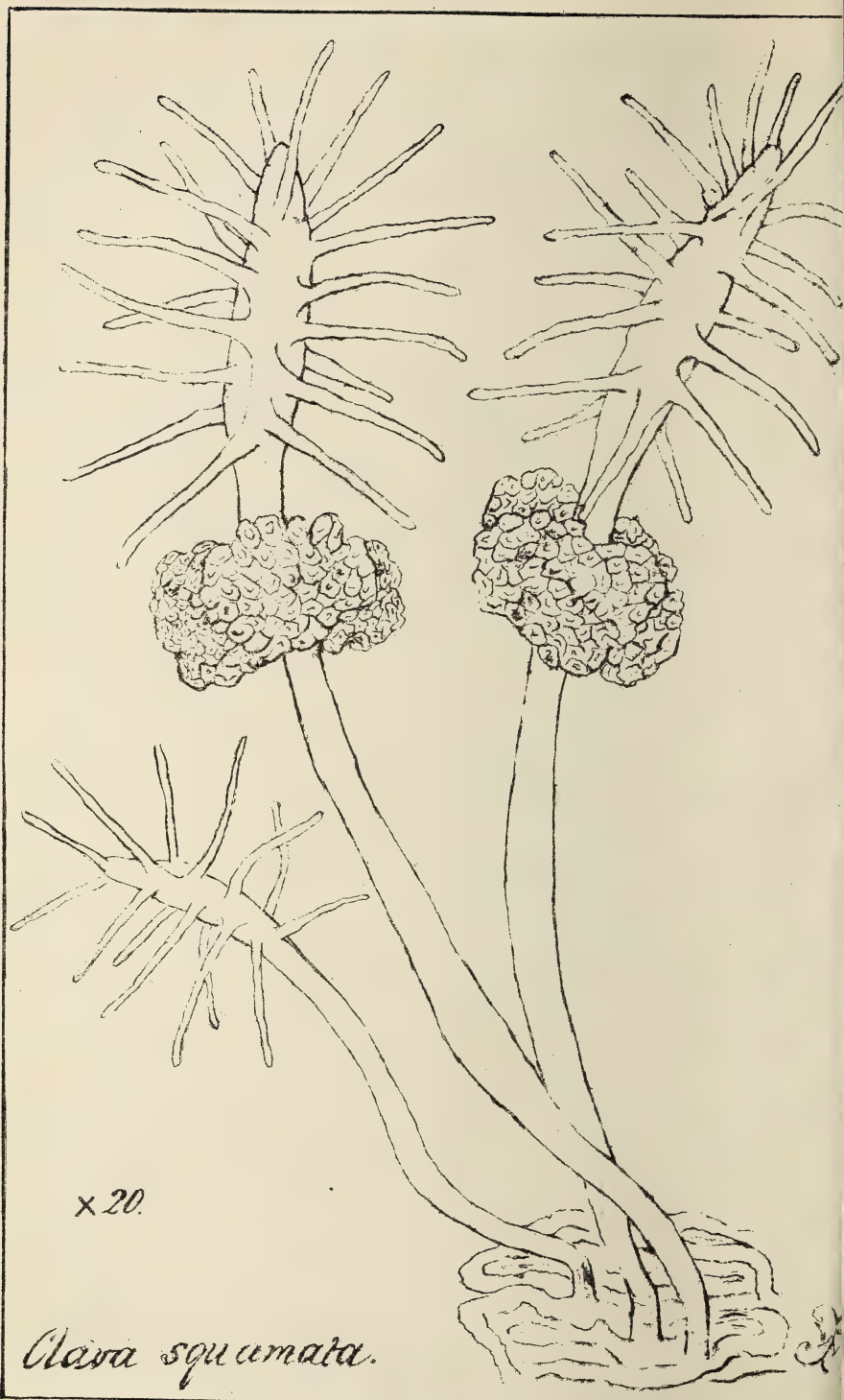


Syncoryne (eximia?) +50

Clava squamata

This beautiful Club Coralline is described by Prof. Allman in his Tubularian Hydroids as follows. Trophosome.—Hydrocaulus, about one twentieth of an inch in height, consisting of minute, simple, closely aggregated tubular offsets from the surface of the Hydrorhiza. Hydrorhiza formed of closely approximated imbricating tubes, ~~and~~ united to one another along their sides by an extension of their perisarc, so as to form a continuous basal expansion. Hydranths very much elongated, somewhat fusiform between the rudimental hydrocaulus and the club-shaped head, when fully expanded attaining a height of about one inch, closely approximated at their base, so as to form a tassel-like cluster; tentacles about twenty. Gonosome.—Gonophores in clusters springing from the body of the hydranth immediately behind the proximal tentacles, each cluster carried upon a very short peduncle. Colour.—A clear yellowish-red, with pale hyaline tentacles. Generally distributed round the shores—especially the more northern ones of the British Isles.

Thos. Bolton 57, Newhall St. Birmingham.



x 20.

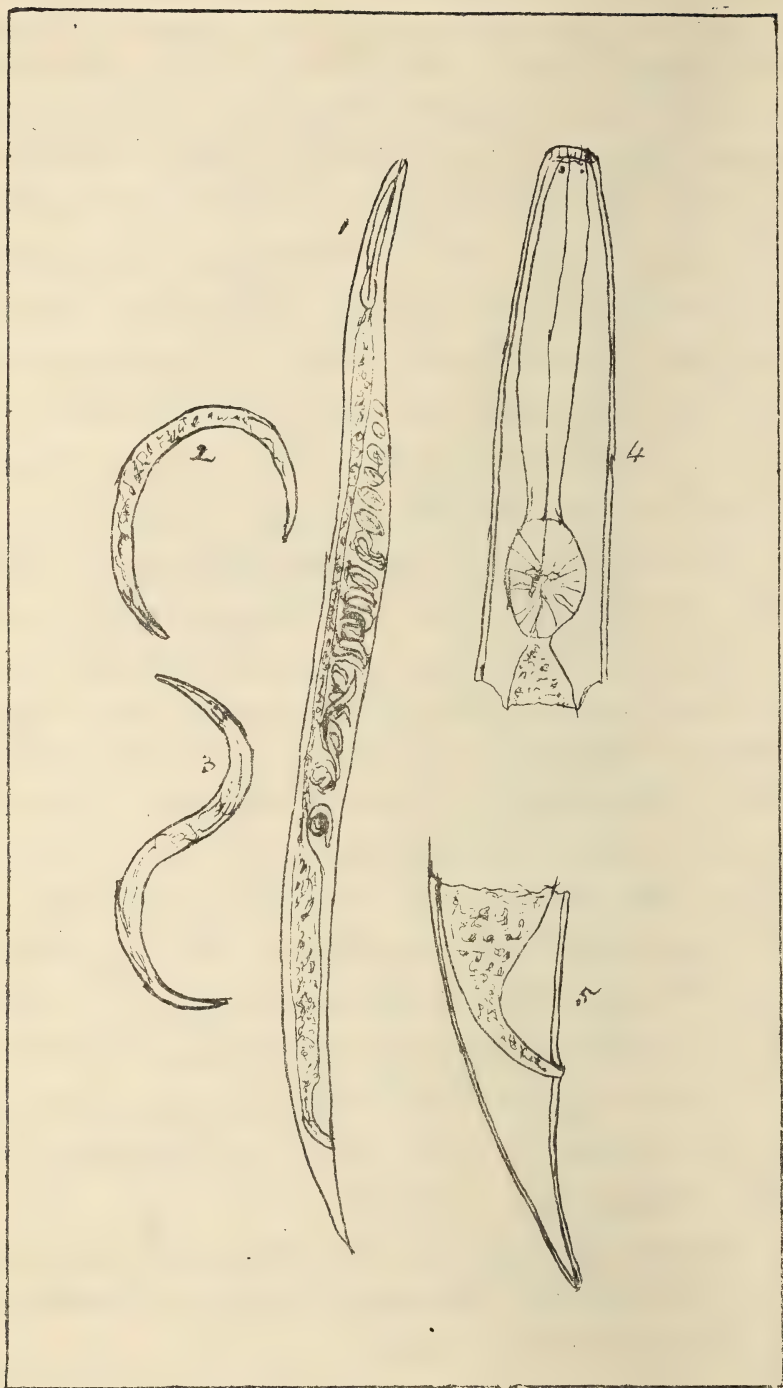
Clava squamata.

Anguillula glutinis.

This nematode worm so common in sour
aste is about 20 times as long as broad,
terminating posteriorly in a fine elongated
point; length $1/15$.— Cobbold in his Entozoa
says— The front of the body is narrowed,
terminating in a slightly abrupt truncate
point, the mouth being central, simple,
and unarmed. The pharynx is prolonged
backwards into a strong, spherical, muscular,
oesophageal bulb; the latter being succeeded
by a long, cylindrical, intestinal tube which
ends in a distinct anal opening, placed a
little above or at the basal portion of the
tail. Some regard the oesophageal bulb
as the stomach, and all recognize, within
it, a special dental apparatus. The tail
is conical and finely acuminate, that of
the male being supplied with two intro-
mittent spicules of equal length. In the
female, which produces its young vivipa-
rously, the vaginal outlet is situated a
little beyond the posterior third of the
body. As in other Nematodes, the uterus
simply divides into two oviducal tubes, in
the interior of which the young embryos
may be seen either free or still enclosed
within their egg-shells.

1. Mature female. Fig. 213. Young specimens $\times 100$.
4. Anterior end showing Pharynx & Mastax $\times 400$.
5. Posterior end $\times 400$.

Thomas Bolton, 57, Newhall St. Birmingham.



Anguillula glutinis.

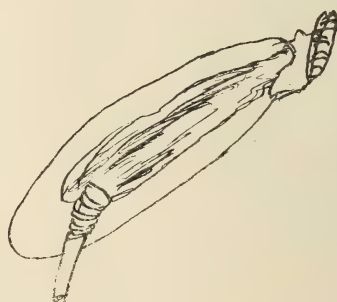
Pterodina clypeata.

This pretty little rotifer abounds now in my Marine aquarium with the *Hollicularia* and *Epirorbis*. They may well be examined in a thin trough and in which they will be found to congregate together in the corner next the light, but for higher powers a few could be examined in a Halls Compressorium or Swells Rotifer Trap (see Hints). This species is oblong shape whereas the common fresh water species *rodina patina* has its shield like lorica nearly circular. A long description of the latter is given in Beck's Pond Life, and another species *P. valvata* is well figured by Dr Hudson in the Monthly Microscopical Journal January 1871.

My correspondents succeed in transferring a number to a thin trough as I have suggested and with a strong light from the lamp on one side, the following remarks of Dr Hudson will be quite applicable.

"I do not think I ever beheld a more beautiful sight than that which the $\frac{2}{3}$ rd objective, illuminated by Ross' $\frac{4}{10}$ th condenser and B stop now gave me. From thirty to forty of these animated shields of glittering glass were swimming every direction across the field, and adhering to the plant, so as to be seen from every point of view; while some had most considerably attached themselves to the glass cover, and were quiet as rotifers ever are."

Thomas Bolton, 17 Ann St. Birmingham Jan^y 14th 1881.



Pterodina clypeata. x 300.

Gammarus pulex.

Very much like *G. Locusta*. Eyes subreniform, black. Superior antennæ having the second joint of the peduncle shorter than the first, third shorter than the second; flagellum twice as long as the peduncle, having twenty-four articuli, broader than long; secondary appendage having about six articuli. Inferior antennæ having the olfactory organ well developed; last two joints of the peduncle subequal; flagellum shorter than the peduncle. Gnathopoda subequal; propodos of the first pair long-ovate, tapering, having the palm very oblique; of the second pair ovate, palm slightly oblique and concave. Penultimate pair of pleopoda as long as the preceding; posterior pair of pleopoda having the ramus subequal and plumose. Colour generally of a yellowish-brown. Length $\frac{3}{4}$ of an inch. Hab. In most of the freshwater streams of England and probably of all Europe.

The above description is taken from C. Spence Bate's Amphipodous Crustacea. *G. fluviatilis* is the only other freshwater *Gammarus* is distinguished from the *G. pulex* by having a dorsal spine at each abdominal joint whilst in the latter this is absent.

Thos Bate. 54, Newhall St. Birmingham

Gammarus Pulex



The Mantis Shrimp

We can never take a living specimen of that beautiful zoophyte *Plumularia cristata*, without finding its numerous pinnated branches inhabited by curious Crustacea of the genus *Caprella*. They are ^{as} much at home in the tree-like zoophyte, as a family of monkeys in their arboreal quarters, and indeed their agility as they run from branch to branch, catching hold of a twig just within reach and pulling themselves in an instant up to it, then stretching out their long arms in every direction, strongly remind me of the Spider Monkeys of South America. One needs little systematic knowledge to see that they are highly predatory: a glance at their form and manners would reveal that fact. Strange spectre-like creatures they are: or rather skeleton-like, with long slender bodies composed of few joints, and wide-sprawling limbs set at remote distances. And such limbs! Two pairs of stout antennae armed with stiff spines project from the head, then the first and second pairs of legs, (but especially the latter,) have the last joint but one developed to a great size, while the terminal joint is so formed as to shut down upon it just as the blade of a clasp-knife does upon the handle. Then to add to the efficiency of this instrument of prehension, the great joint which represents the haft is armed with a double row of spines set at an angle so as to make a groove, into which the blade falls, and this latter is cut along each side of its edge into fine teeth like those of a file. I find several species even on the same small fragment of weed, if it be tolerably well peopled with *Plumularia* or *Psittacella*, some much larger than others, and beautifully mottled with transparent ruby colour on a clear horn, and distinguished by variations in the relative size in the shape, and in the armature of these formidable weapons, and there is a species larger still, of a dull purplish-red hue. But all have pretty much the same manners, except that the smallest species are more agile." Gosse's

Devonshire Coast.

1853. The Botton St. Marshall St. Birmingham



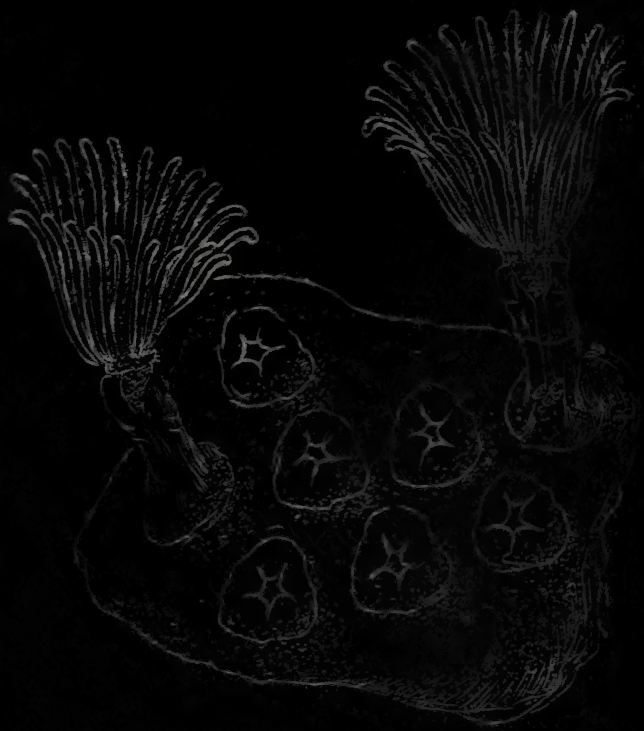
Caprella lobata

Female.

H. E. Forrest. del.

ALCYONIDIUM POLYOUM.

I am not quite certain that the specimen I send is this species ; but, I think, it most closely corresponds with the sketch on the other side, copied from Mr. Hinck's Manual. The following portion of description of *A. hirsuta* by Mr. Gosse applies to this species equally well :—" Soon a pellucid membranous tube appears pushing out of the mass by a gradual, though quick, unfolding of its everting walls ; a bundle of parallel fibres now protrude from the extremity, which, when they have attained the length of the tube itself, fall open at their tips, and constitute a beautiful bell of sixteen tentacles. Each tentacle now presents the form of ciliation characteristic of the POLYZOA, consisting of a single series on each lateral edge, so moving that the ciliary wave passes, like dark teeth fast chasing each other, up one side and down the other. No sooner has one bell thus expanded than others on every hand are seen rising and opening in quick succession, until at length they stud the surface as densely as they can stand, looking like the tassels of a fringe, only that they are set in superficial, and not in linear, series. Just below the bottom of the bell, within the membranous tube, is seen the gullet—a canal with thick muscular walls, swelling in the middle—which now and then is observed to dilate and contract with a swallowing action, as some minute atom of food, sucked down the ciliary vortex of the bell, passes through the throat, and is hurled along this œsophageal canal to the gizzard, whose fibrous walls take the form of longitudinal bands, or perhaps folds, at the lower part of the tube."



Alcyonidium polymum

BOWERBANKIA IMBRICATA.

The Zoöcia of this most beautiful of the Marine Polyzoa, grow in groups on an erect, or creeping, stem. Mr. Gosse, in his "Tenby," says:—"In such a cluster, specimens of the animal may be seen in almost every stage of its growth. Here there is a minute pellucid globule seated on the side of the root-thread, from which it is budding, looking like a little grape. Others are lengthening, first to an oval, then to an elliptical form, more or less produced. Others have attained their full size of about 1-10th of an inch long, and their adult form of a long cylinder, but with the extremity rounded and hermetically sealed; for as yet the inhabiting polype is not sufficiently advanced to communicate with the external world, though its immature form and bundle of short dumpy tentacles may be discerned within its clear prison. Others, again, have attained their complete development, and may be observed in different stages of expansion or contraction. By watching the process of protusion, we perceive that the little animal does not differ materially in structure from other POLYZOA; from the Sea-mats, for instance, or from the Stag's-horn. In the former case, the cells are calcareous, rigid, and arranged in regular order; here they are membranous, soft, free, and irregularly clustered. The cells are membranous in the Stag's-horn, but they are imbedded in a common gelatinous flesh, and concealed except when the polype is protruded; here, as I have said, they spring from a creeping thread, and are erect and unconnected with each other, though crowded. The expansion or protusion of the polype is a process of eversion, as when a stocking is drawn off the foot. When the proper muscles are made to contract, the membranous edges of the cell are seen to turn themselves inside-out, lengthening the cell gradually at its upper extremity. At a certain stage, a bundle of stiff straight rods (or *setæ*) emerge from the orifice, the tips of which slightly separate when their evolution is complete. As the process goes on, the tips of the tentacles are seen pushing up from the centre of the fascia of *setæ*; the latter expanding to permit the exit, and, when the tentacles are fully extruded, standing perpendicularly around their base, so closely as to be indistinguishable. The tentacles are not turned inside-out, but simply pushed upward; the point at which the inversion begins being below their base. When fully extended, they open into a bell, or goblet-form, and are seen to be ten in number, ciliated in the usual manner. In this condition the height of the polype is at least double that of the cell, and it is distinctly visible with the naked eye. It forms a very interesting object when viewed by means of transmitted light; its transparent integuments permitting every part of its internal structure to be clearly discerned. But when reflected light is employed, the beauty of the spectacle is greatly increased. The whole of the cells and of the polypes appear as if blown of clear glass, the surfaces of which reflect the light with great brilliancy. This brilliancy is yet further enhanced, if, by delicate manipulation, and adjustment of the mirror of the microscope, the rays from the lamp are made to illuminate the object, while yet not a single ray is allowed to proceed by direct reflection from the mirror to the eye. The polypes are then seen projected on a perfectly dark background, while every line shines out with vivid brightness; the edges of the cells of the polype, of the internal viscera, and of every individual tentacle, having the refulgence of polished silver. Such a sight is worthy of admiration, even by an experienced microscopist."

Triticella pedicellata.

M^r. Hincks in his *Marine Polyzoa*, describes this species as follows. — Zoecia ovate-oblong, transparent scattered along a delicate creeping stolon; the dorsal side (viewed laterally) very slightly curved outwards, the front side occupied almost entirely by the membranous area, which extends nearly to the bottom of the cell. The zoecium (viewed in front) slightly contracted at the base, but of equal width for a great proportion of its length, scarcely narrowed towards the top; no angular projection at the lower extremity of the area. Stenaculum wanting. Peduncle very slender; usually two or three times the length of the cell. Polypide with twelve tentacles. Length of cell $\frac{1}{50}$ inch. This elegant and transparent Polyzoa now (April 1881) encrusts the wall of one of the reserve tanks in the Aquarium at Aston. In many specimens that I have examined the pre-oral cavity is full of the minute wriggling spermatozoa and which are easily seen with a $\frac{1}{4}$ inch objective.

Thos Bolton, 54, Newhall St. Birmingham.



X 120

Triticella pedicellata.

Pedicellina cernua.

Polypides borne on a flexuous, transparent
colon, more or less branched; often densely
clustered. Body whitish, cup-shaped, some-
what compressed laterally, usually very
concentric on one side (the dorsal or anal),
and subtruncate on the opposite; tentacles
12-24. Peduncle stout, tapering slightly
towards the top, and in this variety glabrous
smooth. The movements of the peduncle
are vigorous and lively: the polypides, when
excited, dash themselves vehemently from
side to side; and one striking against another,
the commotion spreads throughout the
colony untill "the effect is that of a field
of corn swept by a strong breeze."

The *Pedicellina* belong to a very small
and exceptional group of the Polyzoa
Entoprocta which have both the orifices
of the alimentary canal within the
lophophore; tentacular sheath wanting;
tentacles bilaterally disposed, not retractile;
no perivisceral cavity.

(Smith's Marine Polyzoa)

Thos. Bolton, 57, Nicholl St. Birmingham.

Saccellina cornuta var. glabra x 150.



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PORTFOLIOS OF DRAWINGS

AND DESCRIPTIONS OF

LIVING ORGANISMS, ANIMAL & VEGETABLE,

ILLUSTRATIVE OF

FRESHWATER AND MARINE LIFE,

WHICH HAVE BEEN SENT OUT WITH THE LIVING SPECIMENS BY

THOMAS BOLTON, F.R.M.S.,

57, NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING EACH.

CONTENTS: AUGUST, 1879. No. 1.

VEGETABLE KINGDOM.

Nostoc commune. | Volvox globator. | Pandorina morum. | Euglena viridis.

ANIMAL KINGDOM.

Uroglena volvox.	Rotifers (7 figures.)	Brachionus pala.
Infusoria (9 figures.)	Synchaeta mordax.	Paludicella Ehrenbergi.
Raphidiophrys pallida.	Hydatina senta.	Embryo of Mussel.
Stephanoceros Eichornii.	Rhinops vitrea.	Larva of Corethra plumicornis
Limnias ceratophylli.	Philodina roseola.	Spawn of Perch.

CONTENTS: FEBRUARY, 1880. No. 2.

VEGETABLE KINGDOM.

Hydrodictyon utriculatum.

ANIMAL KINGDOM.

Spongilla fluviatilis.	Leptodora hyalina.	Carcinus Mænas, in the Zoea
Peridinium tabulatum.	Hyalodaphnia Kahlbergensis,	stage.
Ophrydium versatile.	(Daphnia Bairdii.)	Lophopus crystallinus.
Stentor Barrethi.	Sida crystallina.	Spirorbis nautiloides.
Carchesium spectabile.	Diaptomus Castor.	Circulation in Egg of Trout.
Hydra vulgaris.	Cristatella mucedo.	Young Salmon.

CONTENTS: AUGUST, 1880. No. 3.

VEGETABLE KINGDOM.

Draparnaldia glomerata. | Chretophora elegans. | Chara and Nitella. | Chara fragilis embryo

ANIMAL KINGDOM.

Actinosphaerium Eichornii.	Anuræa longispina and	Bowerbankia gracillima.
Coleps hirtus.	Ceratum longicorne.	Bosmina longirostris
Urostyla grandis.	Melicerta ringens.	Larval Shrimp.
Dinobryon sertularia.	Lacuncularia socialis.	Nais proboscidea.
Vorticella chlorostigma.	Aleyonella fungosa.	

CONTENTS: FEBRUARY, 1881. No. 4.

VEGETABLE KINGDOM.

Desmids and Diatoms
Æcidium urticæ.

Zygnema cruciata.
Vallisneria spiralis.

ANIMAL KINGDOM.

Acineta.	Nassula ornata.	Euchlanis dilatata.
Dendrosoma radians.	Spirostomum teres.	Asellus vulgaris.
Choano-flagellata.	Cordylophora lacustris.	Ilyocryptus sordidus.
Bursaria truncatella.	Lucernaria auricula.	Argulus foliaceus.
Marine Infusoria.		

Hints on the PRESERVATION OF LIVING OBJECTS and their EXAMINATION UNDER THE MICROSCOPE, by THOMAS BOLTON, F.R.M.S. (Reprinted from the "English Mechanic." Price Threepence.

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By DR. J. E. TAYLOR, F.L.S., Editor of "Science Gossip." Crown 8vo., cloth gilt.
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September, 1881.]

C+p.

[No. 6.]

PORTFOLIO OF DRAWINGS,

AND DESCRIPTIONS OF

LIVING ORGANISMS,

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THOMAS BOLTON, F.R.M.S.,

57, NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING.

CONTENTS.

VEGETABLE KINGDOM.

Bacillaria paradoxa.

ANIMAL KINGDOM.

Triloculina trigonula.

Noctiluca miliaris.

Raphidomonas semen.

Epistylis plicatilis.

Vaginicola, &c.

Clytia Johnstonei.

Medusiform gonozoid.

Cercaria (Larval Fluke).

Ceistes longipes and pilula.

Ceistes Janus.

Conochilus volvox.

Rotifer macrurus.

Daphnia pulex.

Larval shrimp.

Fredericella sultana.

Bugula turbinata.

LIST OF ORGANISMS ALREADY SENT TO SUBSCRIBERS.

1878.

- Sep. 13. *Lacinularia socialis*
 " 20. *Cristatella mucedo*
 " 27. *Limnias ceratophylli*, with *Melicerta*
 ringens
 Oct. 4. *Stephanoceros Eichornii*
 " 11. *Plumatella repens*
 " 18. *Stentor polymorphus*
 " 25. *Philodina roseola*
 Nov. 1. *Closterium lunula*
 " 8. *Spongilla fluviatilis*
 " 15. *Floscularia campanulata*
 " 22. " *cornuta*
 " 26. *Hydatina senta*
 Dec. 6. Larval Form (Trochosphere) of Marine
 Polyzoa (*Alcyonidium*)
 " 13. Marine *Polyzoa*
 " 20. *Raphidiophrys pallida*
 " 27. *Volvox globator*

1879.

- Jan. 3. *Euglena viridis*
 " 10. *Loxophyllum meleagris*
 " 17. Spawn of Trout
 " 24. *Ceistes crystallinus*
 " 31. Infusoria
 Feb. 7. *Ceistes*, with other Rotifers
 " 14. Young Trout, (Alvein stage)
 " 21. *Spirostomum ambiguum*
 " 28. *Rhinops vitrea*
 Mar. 7. *Euglena* and *Hydatina*
 " 14. *Plumatella repens*
 " 21. *Spongilla fluviatilis*
 " 28. *Cristatella mucedo*
 April 4. *Synchaeta pectinata*
 " 11. Embryo of Mussel
 " 18. *Nitella translucens*, with *Carchesium*
 polypinum
 " 25. *Batrachospermum moniliforme*
 May 2. Elver (young Eel)
 " 9. Spawn of Perch
 " 16. *Pandorina morum*
 " 23. *Fredericella sultana*
 " 30. *Brachionus pala*
 June 6. *Uroglena volvox*
 " 13. Larva of *Corethra plumicornis*
 " 20. *Asplanchna Brightwellii*
 " 27. *Floscules*
 July 4. *Gonium pectorale*
 " 11. Marine objects (various)
 " 18. *Nostoc commune*
 " 22. *Volvox* and *Plumatella*
 Aug. 1. *Leptodora hyalina*
 " 8. *Hyalodaphnia Kahlbergensis*
 " 15. *Kondylostoma patens*
 " 22. *Vaucheria*
 " 29. *Conochilus volvox*
 Sep. 5. *Brachionus urceolaris*
 " 12. *Sida crystallina*
 " 19. *Lacinularia socialis*
 " 26. *Vorticellidae*
 Oct. 3. *Stentor Müllerii*
 " 10. *Diaptomus castor*
 " 17. *Hydra vulgaris*
 " 24. *Bosmina longirostris*
 " 31. Rotifers (various)
 Nov. 7. Weeds incrustated with Rotifers and Infusoria
 " 14. *Ophrydium versatile*
 " 21. *Hydrodictyon utriculatum*
 " 28. *Peridinium tabulatum*
 Dec. 5. *Draparnaldia glomerata*
 " 12. *Stentor Barretti*
 " 19. *Lophopus crystallinus*
 " 26. *Spirorbis nautiloides*

1880.

- Jan. 2. *Canthocamptus furcatus*
 " 9. *Zoëa* of Crab
 " 16. Spawn of Trout
 " 23. *Acineta mystacina*
 " 30. *Urostyla grandis*
 Feb. 6. Spawn of Char
 " 13. *Synchaeta tremula*

1880.

- Feb. 20. *Zoothamnium*
 " 27. *Rhinops vitrea*
 Mar. 5. *Coleps hirtus*
 " 12. *Nitella Embryo*
 " 19. *Dinobryon sertularia*
 " 26. Glass Larva
 April 2. *Chaetophora elegans*
 " 9. *Asplanchna Brightwellii*
 " 16. Spawn of Perch
 " 23. *Zygnema cruciata*
 " 30. *Brachionus* on *Daphnia*
 May 7. Elver or young Eel
 " 14. *Conochilus volvox*
 " 21. Larval Shrimp
 " 28. *Bosmina longirostris*
 June 4. *Melicerta ringens*
 " 11. *Anuræa longispina*
 " 18. *Hyalodaphnia Kahlbergensis*
 " 25. *Leptodora hyalina*
 July 2. *Vorticella chlorostigma*
 " 9. *Paludicella Ehrenbergi*
 " 9. *Nais proboscidea*
 " 23. *Spirulina oscillarioides*
 " 30. *Protococcus pluvialis*
 Aug. 6. *Alcyonella fungosa*
 " 13. *Argulus foliaceus*
 " 20. *Edogonium ciliatum*
 " 27. *Epiplatys plicatilis*
 Sep. 3. *Daphnia pulex*
 " 10. *Bugula avicularia*
 " 17. *Nassula ornata*
 " 24. *Clava squamata*
 Oct. 1. *Melicerta* and *Floscules*
 " 8. *Cordylaphora lacustris*
 " 15. *Colpidium cucullus*
 " 22. *Pedicellina cernua*
 " 29. Rotifers (various)
 Nov. 5. *Choano-flagellata*
 " 12. *Acineta mystacina*
 " 19. Trochospheres of *Polyzoa*
 " 26. Desmids and Diatoms
 Dec. 3. *Spirostomum teres*
 " 10. *Distigma proteus*
 " 17. *Asellus vulgaris*
 " 23. Ova of *Salmo fontinalis*
 " 31. *Follicularia ampulla*

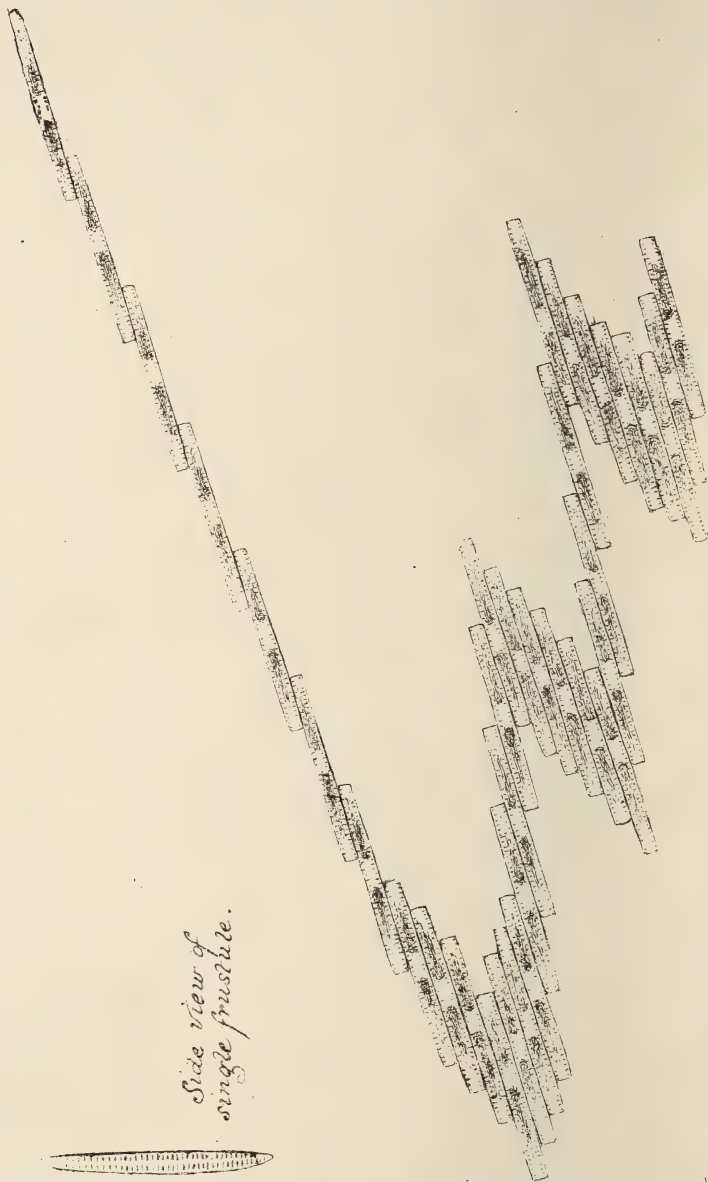
1881.

- Jan. 7. *Bursaria truncatella*
 " 14. *Pterodina clypeata*
 " 21. *Spirorbis nautiloides*
 " 28. *Argulus foliaceus*
 Feb. 4. *Anguillula glutinis*
 " 11. *Opecularia nutans*
 " 18. Trout Fry
 " 25. *Glochidia* (spawn of Mussel)
 Mar. 4. *Batrachospermum moniliforme*
 " 11. *Paramecia aurelia*
 " 18. Salmon Fry
 " 25. *Bowerbankia imbricata*
 April 1. Rotifers (free swimming)
 " 8. *Stentor polymorphus*
 " 14. *Trichodina pediculus*
 " 22. *Gammarus pulex*
 " 29. Elver (young Eel)
 May 6. *Actinospermum Eichornii*
 " 13. *Cercaria* (Larva of Fluke)
 " 20. *Spirogyra* in conjugation
 " 27. *Euglena Viridis* (red stage)
 June 3. *Fredericella Sultana*
 " 10. *Conochilus Volvox*
 " 17. *Planaria Lactea*
 " 24. *Nitella* (in fructification)
 July 1. Larval Shrimp
 " 8. *Raphidimonas semen*
 " 18. *Noctiluca miliaris*
 " 22. *Leptodora hyalina*
 " 29. *Spongilla fluviatilis*
 Aug. 6. *Ceistes Janus*
 " 12. *Bacillaria paradoxa*
 " 19. *Syncoryne eximia*
 " 24. *Medusiform gonozoid*
 " 26. *Lophopus Crystallinus*
 Sep. 2. *Bugula turbinata*
 " 9. *Triloculina trigonula* (Foramini)

Bacillaria paradoxa.

Enclose some of these curious and interesting Diatoms with a variety of other species including *Nitzschia sigmoidea* which I have found attached to alga in the Canal in this neighbourhood. Its usually attributed habitat is brackish water but I have before found it in this Midland district. It is best examined by placing a little of the sediment and alga in a hollow slide, covering with thin glass, under a $\frac{1}{2}$ inch or $\frac{3}{4}$ inch objective. The characteristic movement will be more readily seen if the slide is laid aside flat for 5 or 10 minutes before examining. The following extract from Dr. Carpenter's *Revelations of the Microscope* new Edition just published and much enlarged price 6s.) Paragraph 221 clearly describes this movement. Most of the Diatoms which are not fixed by a stipes possess some power of Spontaneous Movement; and this is especially seen in those whose frustules are of a long narrow form, such as that of the *Naviculae* generally. The motion is of a peculiar kind, being usually a series of jerks, which carry forward the frustule in the direction of its length, and then carry it back through nearly the same path. Sometimes, however, the motion is smooth and gradual; and this is especially the case with the curious *Bacillaria paradoxa*, whose frustules slide over each other in one direction until they are all but detached, and then slide as far in the opposite direction, repeating this alternate movement at very regular intervals. In either case, the motion is obviously quite of a different nature from that of being possessed of a power of self-direction. "An obstacle in the path," says Prof. H. Smith, "is not avoided, but pushed aside, or, if it be sufficient to avert the forward course of the frustule, the latter is detained for a time equal to that which it would have occupied in its forward progression, and then returns from the impediment as if it had accomplished its full course." The character of the movement is obviously similar to that of those motile forms of *Rhodophyta* which have been already described; but it has not yet been definitely traced to any organ of impulsion; and the cause of it is still obscure."

Geo. Bollen, 57, Nicholl St. Birmingham. Aug 5th 1881.



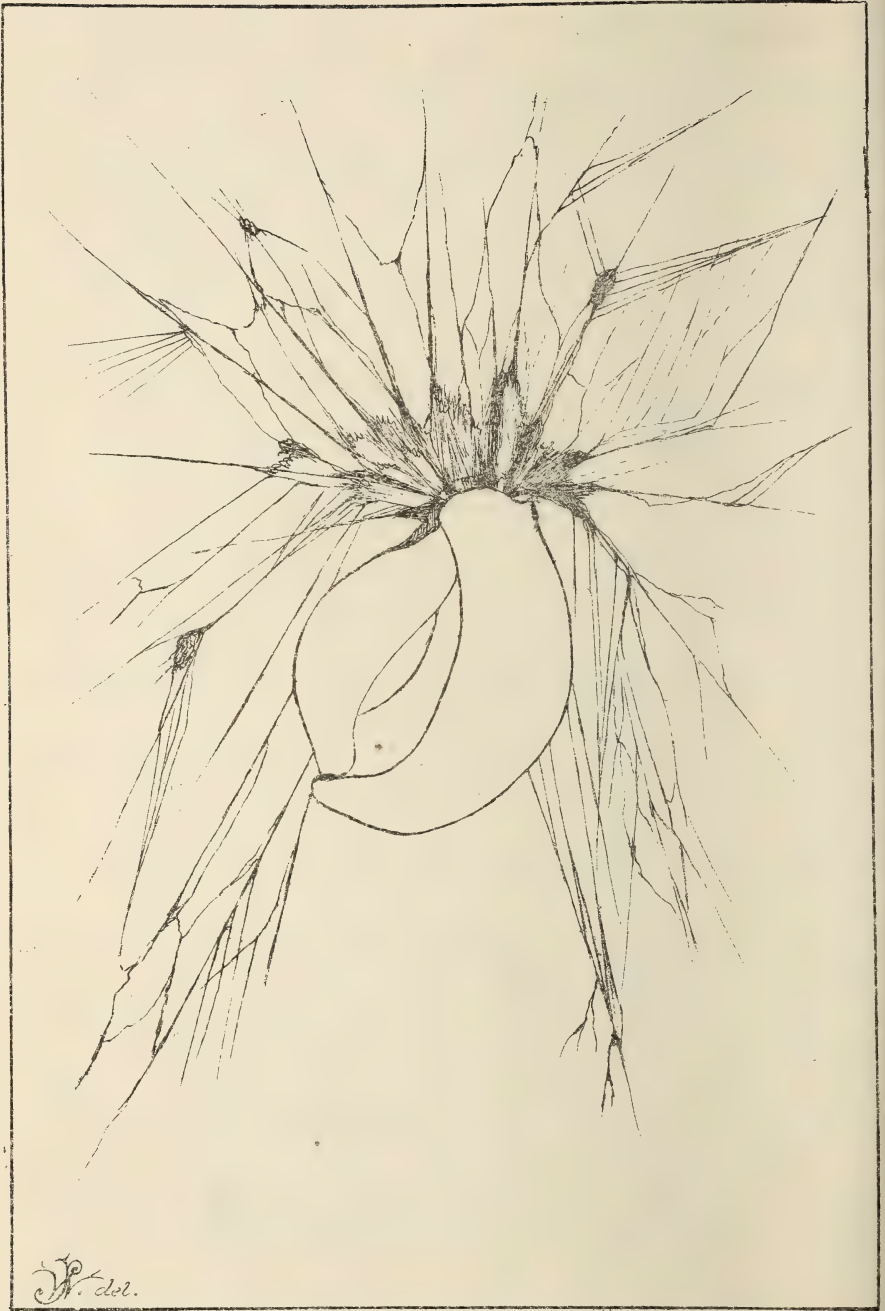
*Side view of
single frustule.*

W. aer.

Triloculina trigonula

With this I send some specimens of living
Foraminifera collected at Brighton.

The shells look like tiny white stones, and
could be transferred with a dipping tube to
a glass slide, covered and allowed to stand
quiet for half an hour. When examined under
good dark field illumination the pseudopodia
will be seen radiating out and anastomosing
with each other, so characteristic of the
Foraminifera. A very complete general
description will be found in Carpenter's
Revelations of the Microscope. The Triloculina
belongs to the Porcellanous and imperforate
group, and is described as follows in Williams's
British Foraminifera. Shell orbicular consisting
of three visible segments. The outermost segment
with two thick rounded umbilical margins
visible, and extending the length of the shell,
enclosing portions of the second and third segments.
The second segment having one rounded margin
visible and embracing the third, of which but
a small oblong portion is seen in the centre of
the side of the shell. Apertures more or less
rounded, furnished with a usually bifid tooth.
Color porcellaneous blue white of the shining long sp.
The British of Marshall & Birmingham.

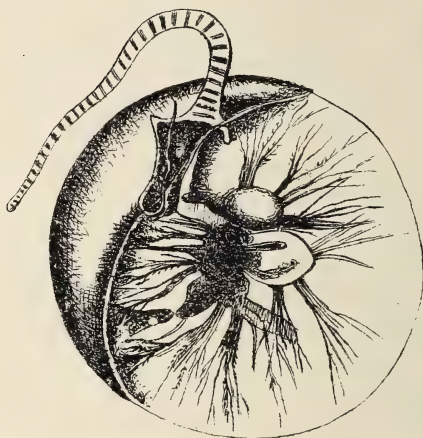


TRILOCULINA TRICONULA.

Noctiluca miliaris.

Body hyaline, peach-shaped, somewhat compressed with a distinct meridional groove; oral fossa situated at one extremity of the meridional groove, having on one side a hard, tooth-like projecting ridge, close to one end of which the vibratile flagellum takes its origin, tentaculate appendage transversely striate, its length about equal to the diameter of the body; a narrow ridge or rod-like induration of the cuticular membrane extending in a straight line from the aboral extremity of the meridional groove through about $\frac{1}{2}$ of the circumference of the body, and there terminating abruptly. Endoplast oval, subcentral. Diameter $\frac{1}{10}$ to $\frac{1}{20}$. Hab. - Pelagic, cosmopolitan; eminently phosphorescent. As remarked by Prof. Allman, there is perhaps no one of the phosphorescent animals as yet known to science that possesses such highly luminous properties as *Noctiluca miliaris*. The presence of this animalcule in countless myriads upon the upper stratum of the water on calm summer nights is due especially to that diffused form of phosphorescence that is more essentially characteristic of temperate latitudes. Under the most favourable of these conditions the waves falling upon the sand leave as they retreat a glittering carpet of scintillating points, the ours of the passing boat seems to dip as it were into molten silver, while on the high seas the waste of waters churned into foam by the revolving screw or paddles of the steam vessel leaves in its wake a broad luminous track as far as the eye can reach. A glass full of water taken from the surface of the sea at such times immediately reveals the origin of this wonderful phenomenon; here and there will be seen floating minute, bladder-like, transparent spheres, resembling as nearly as possible small granules of boiled sago, and which exhibit on closer investigation with the microscope, the structural characters given in the foregoing diagnosis. Irritated by agitation or any sharp motion they at once respond by, as it were, angry flashes of ivory greenish light, and it is to the coruscations in their aggregate condition of millions of these minute bodies that the several phenomena above recounted are produced. Extract from Mr. Hents description in his Manual of the Microscopist. Page 394. In the drawing it is shown partly in section after Huxley (in his Invertebrata). There is also a good account of it in Carpenter's Revelations of the Microscopist.

Thomas Bolton, 57, Newhall St. Birmingham.



J. P. Ael.

NOCTILUCA MILIARIS.

Raphidomonas semen.

Mr. W. Saville Kent has identified these Infusoria for me. He says he had not previously seen this very interesting type; nor has it I think so far been recorded in Great Britain. He writes "Just observed they possess the property of springing forwards or backwards for a short distance. So called trichocysts probably springing hairs." It is figured in Plate XX figs. 60-62 in his Manual of the Infusoria and is described as follows. "Body elongate-ovate, flexible and somewhat variable in form, usually rounded and widest anteriorly, tapering and slightly attenuate posteriorly, from two and a half to three times as long as broad, flagellum scarcely equalling the body in length, issuing from the anterior oral fossa pharyngeal chamber subtriangular or lunate, transversely placed; contractile vesicle single, anteriorly situated; endoplast large, ovate, subcentral; endoplasm green; trichocysts most abundant along the anterior margin. Length 1.5; 56 100. Hab. - Marsh water, among decaying Sphagnum movements sluggish, vacillating."

These specimens were found in a similar situation in Sutton Park.

The Botter 54. Newhall St. Birmingham Sept 1861.



x 650 .

W. Del.

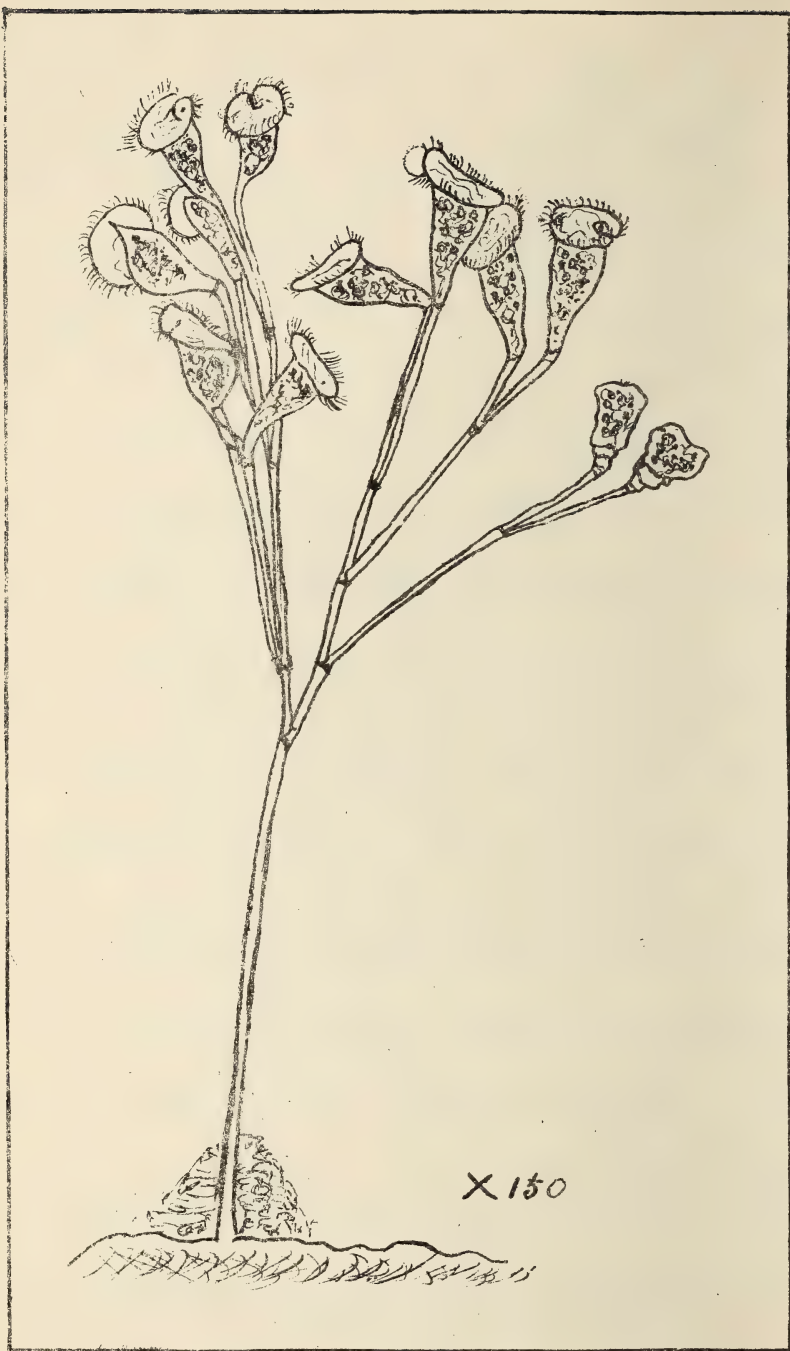
RAPHIDOMONAS SEMEN.

Epistylus plicatilis

I have lately found the stems of some water plants encrusted with this pretty little Vorticellida. In examining it with the pocket lens I took it to be *Earchesia* polypinum, which in the general arrangement of its clusters (when expanded) it much resembles, but a higher magnifying power reveals the characteristic differences. The stem or pedicle, as in all species of *Epistylus*, is rigid, but the individual Looid is contractile (in this species in annular folds). The Looids are conical and elongated; frontal margin dilated, truncated, and slightly projecting; pedicle dichotomous, often corymbose, smooth or, when foreign bodies adhere, of a scaly appearance.

It is described by Mr. H. Sewall, Kent in his *Manual of the Infusoria*, page 74, plate 35.

Thos Bolton, 57, Newhall St. Birmingham.



Epistylis plicatilis.

Infusoria

Symbiote on the Fresh-water Shrimp.

It is surprising what a number of organisms are often found flourishing on these crustacea. Numbers of the common wheel Animalcule (*Rotifer Vulgaris*) may be always found attached like a lot of leeches to its body amongst the legs, and also round the mouth and anus sometimes crawling about, and at others stretched out and vigorously working their wheel like auxiliary wreaths diligently drawing in food to be ground between the hammer and anvil of their gizzard. In looking over some specimens I was sending out, I was struck by seeing three species of Infusoria which were new to me so I sketched them and Mr. W. Saville Kent has kindly identified them as being N^o 1 *Platycola* (*Vaginicola*) *longicollis* see Plate XL fig 35 in his Manual, and fig. 2 *Loothamnium affine*, and fig 3 *Spirochona gemmipara* are described and the latter figured in Richards Infusoria. The *Platycola* and *Loothamnium* were distributed over the body and limbs of the Shrimps; and the *Spirochona* bristled like a fringe all round the edge of the Branchial plates.

Thomas Bolton, 57 Nicholl St. Birmingham.

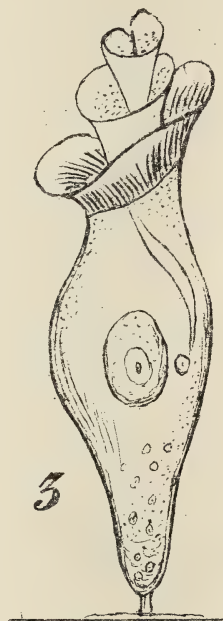


Fig 1. *Virginicola* Sp.:? . $\times 700$

Fig. 2. *Loothamnium affine* $\times 400$

Fig. 3. *Spirochona gemmipara* $\times 500$

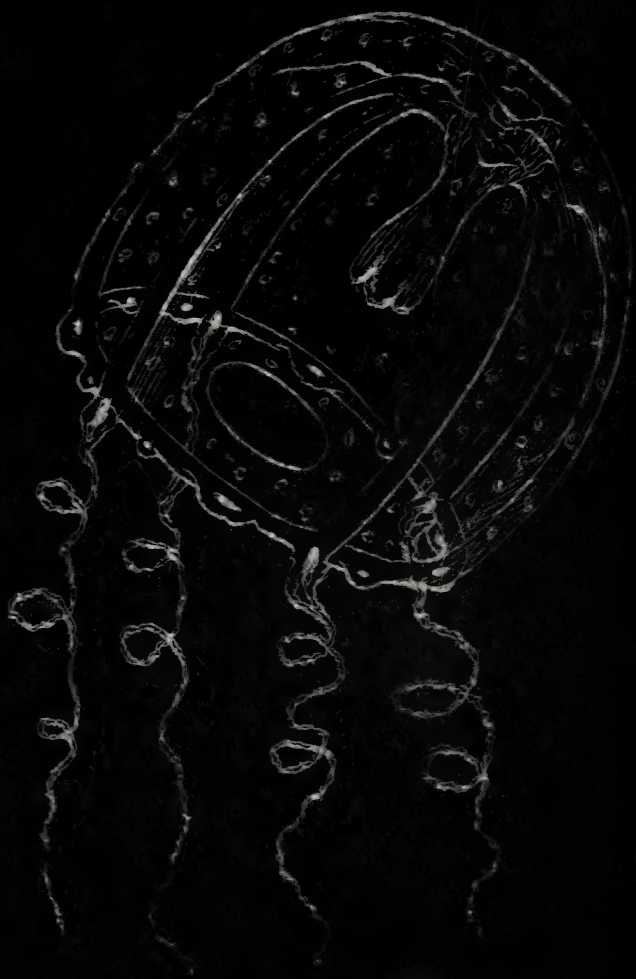
Umbrella (at times of liberation) globose, perfectly transparent, with numerous thread-cells imbedded in its substance, and a very wide velum; Manubrium short, somewhat swollen towards the base, with a four-lipped mouth; Marginal Tentacles very extensile, muricated, halfway between each pair of small tubercle (rudimentary tentacle) with a lithocyst on each side of it.

It is a most exquisite organism, about $\frac{1}{10}$ of an inch in height at the time of liberation, of graceful form and the purest transparency; its presence is indicated to the naked eye by five opaque-white dots, marking the four arms and the manubrium. The perfectly translucent umbrella can only be detected by the aid of a lens. The arms during motion are curled up in several spiral coils, but are capable of great extension. The reproductive sacs are borne on the radiating canals as minute globular enlargements. Each of the lithocysts on the free margin of the umbrella contains a single spherule of carbonate of lime, which is highly refractile. These charming little floating polypsites are cast off in immense numbers by the fixed colonies of the *Elytia*, each freighted with the seed of new generations; so that we may not wonder at the profuse distribution of the species.

From Hincks' British Hydrozoa.

I am glad to be able to send to some of my subscribers specimens of this pretty little jelly-fish, which have appeared in a small finger glass aquarium on my table in which I had placed a few sprays of sea weed (collected at Brighton on Aug. 15th) to which were attached some scattered specimens of the *Hydrozoan Elytia Johnstoni*. The Gonozooids have apparently been liberated from the Gonotheca last night.

Thos. Bolton, 57 Newhall St. Birmingham. Aug. 24th 1881.



Medusiform gonozooid of
Clytia johnstonei

Elytia johnstoni.

E. johnstoni is one of the commonest of our British Campanulariidae. The calyces are generally large and the pedicels of great length; but there is considerable variation in these points; on the same specimen the calyces are often of the most various sizes. The denticulation of the margin is strongly marked. The stems for the most part have the middle portion smooth; but there is sometimes a little ringing even here, and I have met with a variety (which I do not venture to separate from *E. johnstoni*) in which they are closely ringed throughout. The capsule is more or less produced, and the rings upon it are much more clearly defined in some specimens than in others. The polypite is large and handsome, with between 20 and 30 long, muricated tentacles.

Stems long, transparent, simple or slightly branched, ringed at the base and at the top, the intermediate portion generally smooth; Hydrothecae deeply campanulate, rather large, expanding slightly above, with 10-12 strong triangular teeth round the rim; Gonothecae borne on the creeping stolon, and occasionally on the stem, ovate, strongly ringed transversely - the segments more or less arched - truncate at the top and shortly pedunculate.

From Hincks' British Hydroids.

Thos. Bolton, 5th Newhall St. Birmingham.

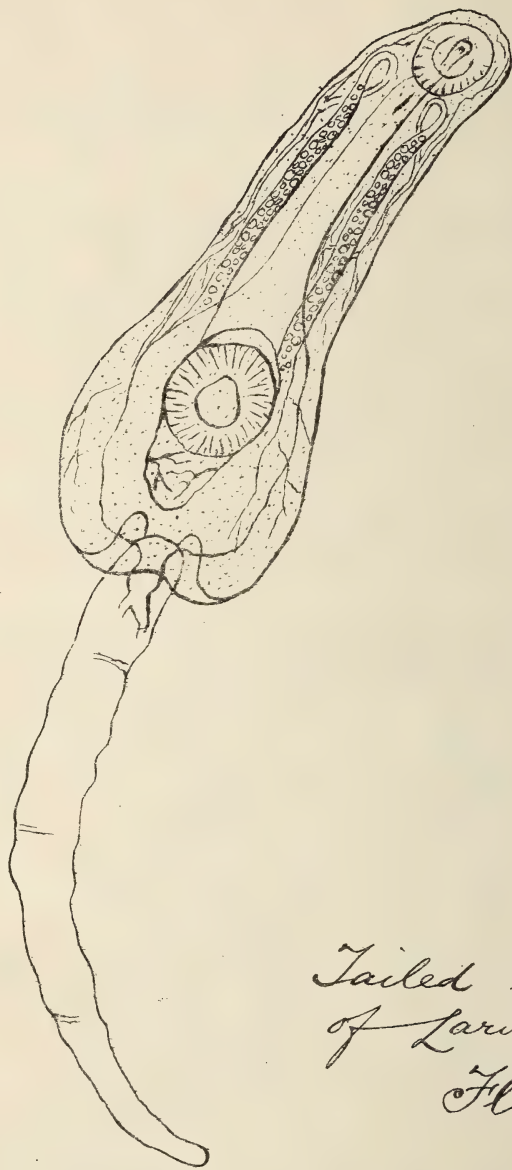


CLYTIA JOHNSTONI.

Cercariae, or Tailed Larvæ of the Fluke.

By the courtesy of one of my correspondents I am enabled to send to my subscribers some specimens of Cercariae in this curious stage as they have escaped from the intermediate hosts the Lymnaea (water snail). They will be seen in the tube like minute Tadpoles ($\frac{1}{16}$ inch long) occasionally swimming by the vigorous lashing of the tail, and at other times crawling like a leech by the alternate attachment of the suckers, one surrounding the mouth and the other about the centre of the ventral surface. Within a comparatively late date Cercariae were grouped with the Infusoria, and I believe there is still much of their Life History to be worked out which is most important to the Sheep Farmer. I see some of the specimens have already lost their tails, although bold in his Entozoa says they probably part with their tail after entering the liver of the sheep. A figure of the *Cercaria furcata* will be found on Plate 42 of the Micrographic Dictionary, and a good illustrated article by Dr. Jabez Hogg in the English Mechanic June 1880 Page 306. There is also an elaborate report of experiments on the development of the liver-fluke (*Fasciola hepatica*) by A. P. Thomas to which Prof. Rolleston contributed in the Journal of the Royal Agricultural Society for 1881.

Thomas Bolton, 54 Newhall St. Birmingham.



*Tailed stage
of Larva of
Fluke.*

NOTE ON A THECATED ROTIFER FROM SUTTON PARK.

[Reprinted from the *Midland Naturalist* for December, 1878.]

The last number of the "Midland Naturalist" contained a description of the rare Rotifer *Æcistes pilula*, which I first exhibited at a meeting of the Birmingham Natural History and Microscopical Society on the 11th of June last. The same pool in Sutton Park, whence I obtained that species, has since yielded a thecated Rotifer of large size and singular beauty, apparently not yet described, unless indeed it be identical with one recently shown by Mr. Oxley at a meeting of the Royal Microscopical Society, of which Mr. T. Bolton exhibited a drawing at the June meeting of the Birmingham Society. In the absence of all measurements it is difficult to decide whether these two animals represent the same species, but the diameter of the trochus in Mr. Oxley's drawing appears greater than it is in my specimens, and the latter clearly show two tentacular processes, while his figures show only one, though this may result merely from the position in which the animal was sketched. But as both my observations and drawings were made before I had heard of that gentleman's, I beg leave to append a brief description, together with figures drawn under the microscope to an accurate scale, premising that, as I have only found two individuals, such description is necessarily imperfect, and that I hope next season to be able to renew my observations.

If the species has not yet received a name, I would suggest that, from the length of its slender foot-stalk, it may be appropriately christened *Æcistes longipes*.

I also give figures of *Æcistes pilula*, drawn to the same scale.

Æcistes longipes.—Total length of animal when fully extended, .045in.; when retracted, .026in.; diameter of trochus, .014in.; height of theca, .035in.; greatest diameter of theca, .029in. Theca semi-transparent, milky-white when viewed by dark back-ground illumination. Cilia of the circular trochus conspicuous, those of the cingulum clearly visible under a 1in. objective. Mastax occupying more than half the diameter of the neck. Tentacular processes two, apparently without terminal setæ.

Ova carried after emission at base of foot-stalk. Foot-stalk corrugated, especially when retracted.

Æcistes pilula.—Dimensions of an average specimen:—Total length of animal when fully extended .025in.; longer diameter of trochus, .005in.; shorter diameter, .003; height of theca, .018in.; greatest diameter of theca, .007in.

A. W. WILLS.

DESCRIPTION OF FIGURES.—PLATE V.

Figs. 1 and 2.—*Æcistes longipes*.

Figs. 3 and 4.—*Æcistes pilula*.

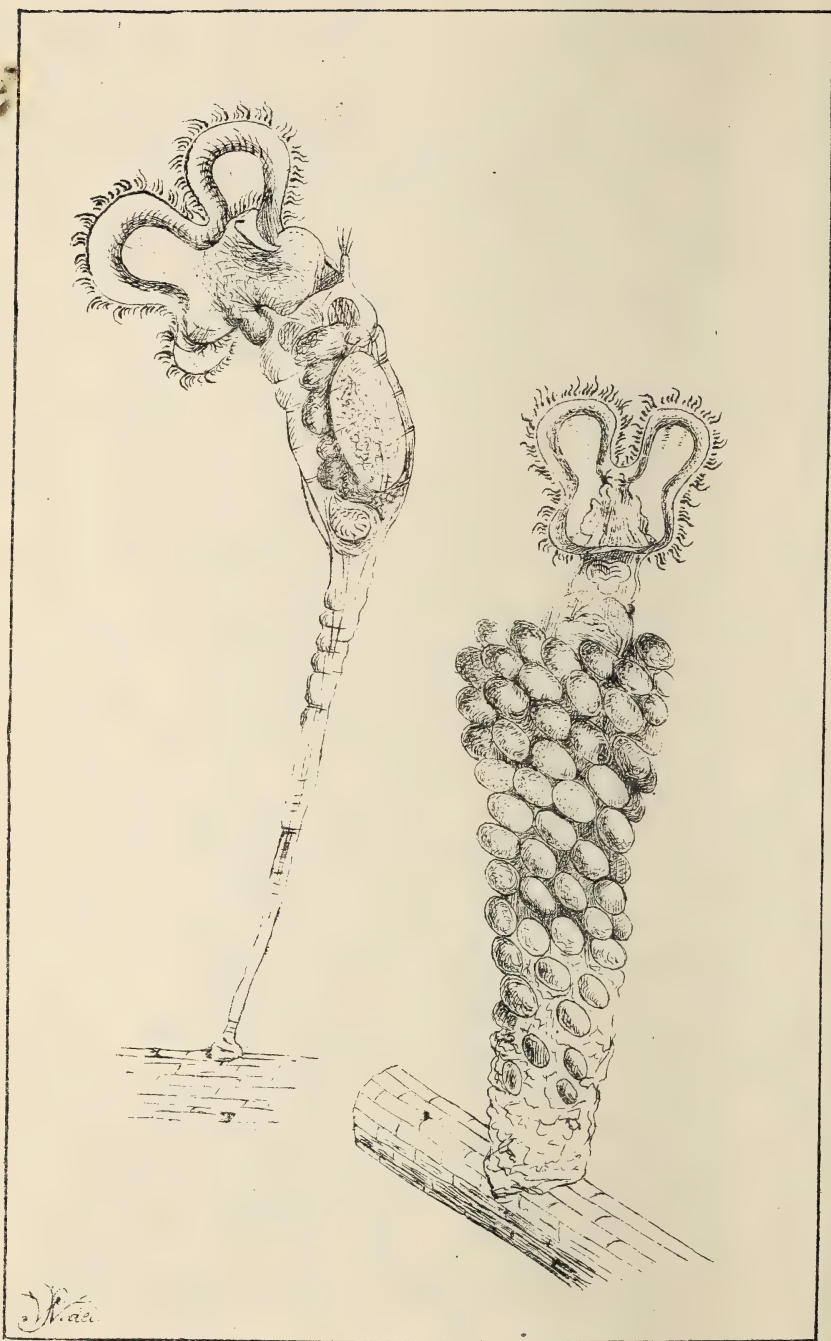
Plate V.



Acistes Janus.

a paper read before the Royal Microscopical Society
on 8th 1880 by Dr. Hudson, and published in the Journal
February 1881 Dr. Hudson writes. "The new tube-making
annelid, *Acistes janus*, was discovered by Mr. J. Hood, of Dundee,
Dundee, in September of this year (1880). It appears
to prefer deep water as its habitat, and is found in the
finest number and best condition, Mr. Hood tells me,
at a depth varying from 6 to 10 feet. At first sight it was
naturally supposed to be a specimen of *A. pilula*, which,
far as its tube is concerned, it very closely resembles; but
on unfolding of its trochal disk at once showed Mr. Hood
that he had secured a prize. *A. janus* is a most striking
addition to the Melicertidae, for it forms a connecting link between
the two genera *Acistes* & *Melicerta*; the upper half of its trochal
disk being that of the latter, while the lower half is that of the
former. Seen from the oral surface as in fig. 2, no one would suppose
it to be other than a true *Melicerta*, living in a tube of faecal
pellets; but viewed from the antoral surface, its relationship
to *Acistes* is at once apparent, for though the upper half
of the trochal disk is deeply cleft into two lobes (just as in *Melicerta*),
the lower half is almost a single lobe, there being the slightest
possible hint of a notch at the lowest point. It would seem
then, at first, as if this new species ought to decide the point as to
whether the five genera, *Acistes*, *Limnias*, *Tubicolaria*, *Melicerta*,
and *Cephalosiphon* should be reduced to one, as Gosse proposed
nearly twenty years ago; for as the form of the trochal disk
is one of the main differences between these genera, the
existence of a species possessing half the trochal disk of one
genus and half of another, shows, one would say, that the
separation of the genera cannot easily be maintained. Gosse
thought that the differences of the trochal disks, &c., were not
sufficient to warrant the formation of five genera of such
similar creatures, especially when, as was the case when he
wrote, each genus contained but one species."

G. Bolton, 5, Newhall St. Birmingham.



OECISTES JANUS.
(after Dr C.T. Hudson)

Conochilus Volvox.

I am glad again to find this species in abundance. It is one of the most charming of the very interesting group of Rotifers. When placed in a thin Loophyte trough they will soon collect in the corner of the trough nearest the light, and can be readily examined under an $\frac{1}{2}$ in. or $\frac{2}{3}$ in objective with darkfield illumination. Gosse in his "History of the Rotifera" Popular Science Review Vol 1. (1862) says "The clusters are very distinctly visible to the naked eye, swimming slowly along, ascending or descending, by the motion of the powerful cilia that surround the head. Each cluster consists of many individuals united by the extremity of the foot, and radiating from a common centre in every direction. This Rotifer is also well figured and described by Mr. Henry Davis in the Monthly Microscopical Journal of July 1876. A copy of which I can supply at $\frac{1}{6}$ post free.

It is unfortunate that these grouped rotifers are apt under certain conditions to break up in the transit by post, so if my subscribers should find these do so I must ask them to advise me and I will take the first opportunity of sending them a second consignment of the same.

Thomas Bolton, 57 Newhall St. Birmingham. June 10th 1881



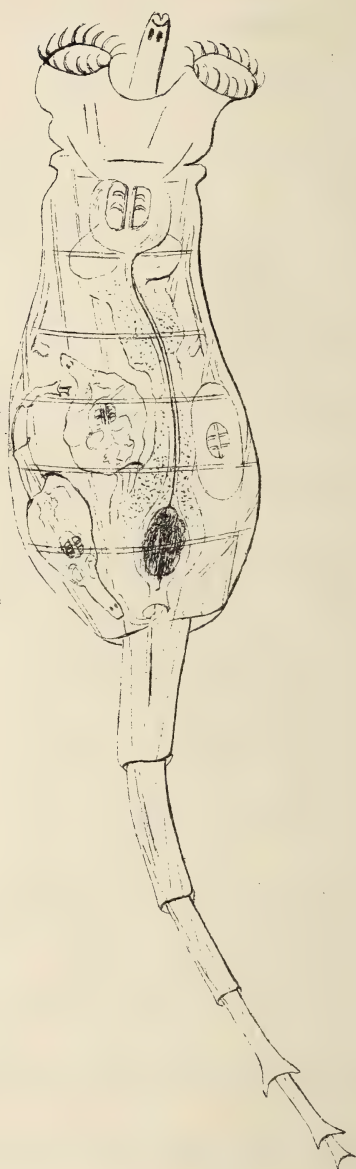
Del.

CONOCHILUS VOLVOX.

Rotifer Macrurus.

Transparent, ovato-oblong, suddenly attenuated into a long foot; this is distinguished from *Actinurus* by its small toes, horn-like processes, and suddenly-attenuated body. The style, or antennal tube, is ciliated in a star-like manner. The wheels are prominent. A long stomach is succeeded by a short intestine; on each side is a convoluted water vascular canal, but without vibratile tags. Eyes either two, hemispherical, abruptly truncate anteriorly, and with a refracting medium, or elongated posteriorly, becoming divided into several rows of linear points, without refracting media. It is altogether a choice subject for the microscope. In boggy water. 1-350". Compare this with drawing of *Philodina roseolaria* in Portfolio N. 1. The characteristic difference between the *Philodina* and *Rotifer* is that in the latter genus the two eye spots are placed upon the frontal proboscis, where as in the *Philodina* they are on the neck.

Thos. Bolton, 54 Newhall St. Birmingham.



J.P. del.

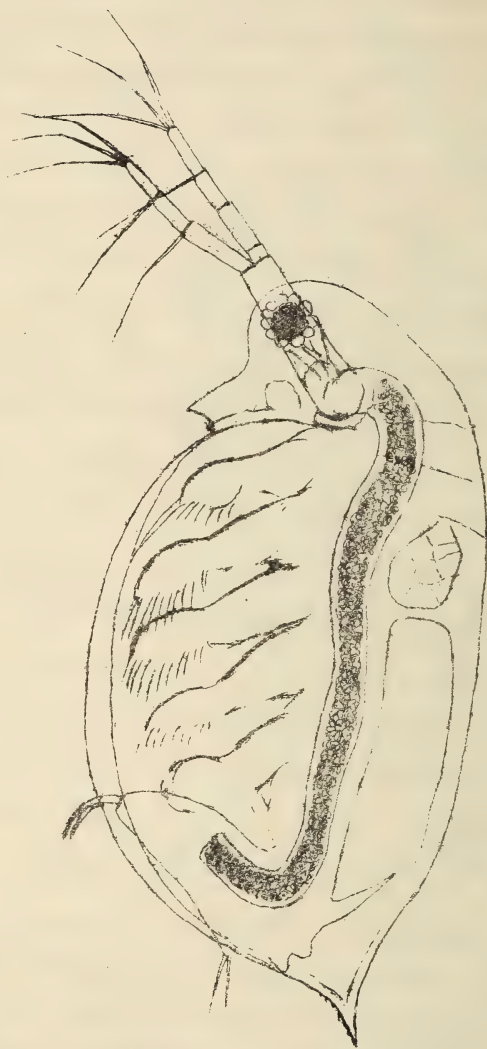
ROTIFER MACRURUS.

Daphnia pulex.

Baird describes this Entomostrakon as follows:—

The shell or carapace is oval, quite transparent, & very finely striated on the anterior & middle portion of the valves, the striae crossing & interlacing with each other. Sometimes it is of a red colour. The lower extremity of the valves terminates in a sharp spine; which is serrated on its edges. The spine varies in length in general, in the adult, being short & straight; in some it is a prolongation of the dorsal margin, in others it is directly in the centre, but in the young, & in var. *L.*, it is long, and slightly bent backwards. The head is large, rounded on the upper & anterior portion & produced lower down into a sharp, pointed beak. The superior antennae are exceedingly small, consisting of only a slight protuberance; & five or six setae. The inferior antennae are very large. The anterior branch consists of four articulations, the first of which is very short. From the extremity of the third, issues a long filament; & from the apex of the fourth, three others arise of equal length. The posterior branch has only three articulations, all of nearly equal length. From the first & second a long filament is sent forth, & three others spring from the extremity of the third. These filaments are all beautifully plumose & have a joint at about the middle of their length. The sixth segment of the body has four projections issuing from it, the first being prolonged, and bent upwards.

Thos^d Bolton, 57 Newhall St. Birmingham.



Daphnia Pulex

H. E. Forrester del.

Larval Shrimp - Crangon Vulgaris.

On May 21st 1880 I sent round to my subscribers some of these larvae in their earliest stage see sketch in Portfolio N^o 3.

These I now send are I think in the very last stage previous to the final moulting. Compare the sessile eyes in the first stage with the prominent stalked eyes of these, also the further developed legs and abdominal appendages, but those of the hinder somites are still imperfect. The action of the heart is readily seen, and of the other internal organs.

Sketches of several of the stages of the Prawn (*Palaeemon*) will be found in Bell's Stalk-eyed Crustacea, but I do not know of any of the Shrimp.

The Student should not omit to examine it under polarized light.

Thomas Bolton, 57 Newhall St. Birmingham.
July 1st 1881.



LARVAL SHRIMP.

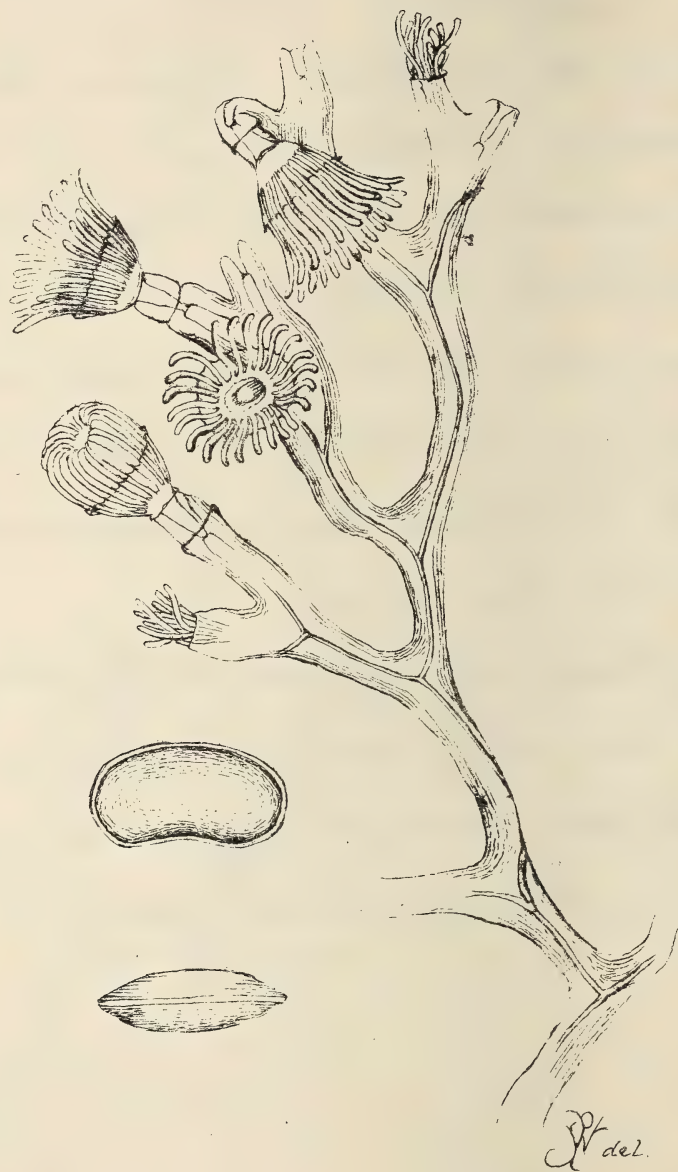
W. del.

Fredericella sultana.

One of the freshwater Polyzoa. Specific character.- Ecenecium, confervoid, composed of a membranocorneous branched tube, with the branches distinct from one another and terminated by the orifices. Lophophore, nearly circular; tentacular crown campanulate, Statoblasts bean-shaped, destitute of annulus and spines.

The student should look for the spermatozoa and ova. The former when present, are easily seen under the $\frac{1}{4}$ inch as a wriggling mass in the intervisceral cavity.

Thomas Bolton, 57 Newhall St. Birmingham.

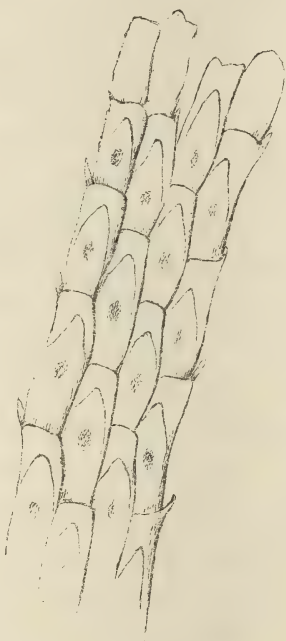


FREDERICELLA SULTANA.

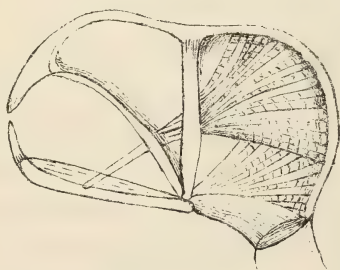
Bugula turbinata

Gosse in his *Devonshire Coast* describes this under its earlier synonym of *Cellularia avicularia*. Well does it deserve the name of Bird's head Coralline, given it by the illustrious Ellis, for it possesses those curious appendages that resemble Vulture's heads, in great perfection. All these specimens of mine were most thickly studded with them, not a cell without its bird's head, and all see-sawing, and snapping, and opening the jaws, with the most amusing activity, and (what was marvellous) equally active on one specimen from whose cells all the polypes had died away, as in those in which the polypes were protruding their lovely bells of tentacles. The polypidoms were distinctly visible to the naked eye, and attracted my attention before I touched them, while yet in their native pool; though of course I did not know what they were until I examined them to better advantage. Some of them stand two inches in height, and are about one third of an inch in widest diameter. The cells are set in longitudinal series, two or three rows abreast, and closely adhering; the branchlets thus formed divide dichotomously, (that is, into two, and each of these into two more, and so on,) and so make broad fan-shaped branches, which are segments of funnels: and the peculiar elegance of this zoophyte consists in the mode in which these ultimate branches are set on the stem, viz. in a spiral turn, so that the effect is that of several funnels set one within another, but which yet are seen, on turning the whole round, to compose one corkscrew band of fans. The stem ascends perpendicularly from a slender base which is attached to the rock, or to the cells of a *Lepralia* which encrust the rock; the midmost part of the spire is most expansive, whence the diminution above and below is pretty regular. The general colour, while alive, is pale buff, but the cells become nearly white in death."

Thomas Bolton, 54 Newhall St. Birmingham.



DORSAL SURFACE.



AVICULARIUM.

J. del.

BUCULA TURBINATA.

PORTFOLIO OF DRAWINGS.

"The Portfolio of Drawings of Living Animals and Plants issued by Mr. Thomas Bolton for June, 1881, is a very creditable production, and we are glad to call our readers' attention to the opportunity there is afforded to them by the labours of Mr. Bolton, of investigating fresh and living specimens of very many interesting forms of animal and vegetable life—for the most part of quite microscopical size—and at the same time of having, by the drawings which accompany these forms, an excellent sketch of what they are to expect to find, and a short but authentic history of what is known about them."—*Nature*, June 16th, 1881.

"We have received No. 5 of Mr. Thomas Bolton's admirable series of drawings, accompanied by short life-histories of the microscopic objects he is in the habit of sending out to his clients."—*Hardwicke's Science-Gossip*, July 1st, 1881.

"Thirty years have elapsed since Ferdinand Cohn, by suggesting the identity of the protoplasm of botanists with the sarcode of zoologists, destroyed for ever the artificial barrier which had been raised between plants and animals, and by showing that both these groups of living things might be studied from one and the same point of departure originated the modern study of the science of biology. It is less than ten years since Huxley and a few of his more ardent disciples introduced the study of biology into England, but during this short period it has made extraordinary progress, and has obtained for itself a place of honour in all recent schemes of liberal education, and is recognised by all universities and colleges which are desirous of keeping abreast with the times.

"Biological study is nothing if not concrete, and thus we find the student is from the very outset brought into contact with some living thing respecting which he has to ascertain for himself the leading facts of structure. Many of these living things are of large size and are easily obtained, such as the lobster, frog, rabbit, earthworm, leech, cockroach, pigeon, and the fern, shepherd's purse, and bean plant. With forceps, scalpel, scissors, and seeker, the coarse anatomy of these organs can be worked out without much difficulty. On the other hand, there are many living things, both plant and animal, which are excessively minute in size, which consequently are not easily obtainable by the uninitiated, and which can only be properly studied on the stage of the microscope. It is for supplying such as these that Mr. Bolton has established his naturalist's studio in Birmingham, and with each specimen sent out he also sends an enlarged drawing and description. These drawings are periodically published in the form of portfolios, each containing from sixteen to twenty drawings, and five such portfolios have now been issued. They are just what they purport to be—'drawings and descriptions of living organisms (animal and vegetable) illustrative of fresh water and marine life, which have been sent out with the living specimens.' Some of the drawings are rather crude, but many are remarkably well done, and taken all in all they are well worth the nominal price charged for them.

"The fact that there should exist a widespread demand for microscopic forms of life is sufficient indication of the rapid advance which biological study has secured in the public favour, and we can honestly recommend all our readers who possess microscopes, or who wish to get a comprehensive view of the lesser living organisms, whether with the object of combining instruction with pleasure, or with the view of preparing for examination in biology, to put themselves in communication with Mr. Bolton."—*Design and Work*, August 13th, 1881.

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LIVING ORGANISMS, ANIMAL & VEGETABLE,

ILLUSTRATIVE OF

FRESHWATER AND MARINE LIFE,

WHICH HAVE BEEN SENT OUT WITH THE LIVING SPECIMENS BY

THOMAS BOLTON, F.R.M.S.,

57. NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING EACH.

CONTENTS: AUGUST, 1879. No. 1.

VEGETABLE KINGDOM.

Nostoc commune. | Volvox globator. | Pandorina morum. | Euglena viridis.

ANIMAL KINGDOM.

Uroglena volvox.	Rotifers (7 figures.)	Brachionus pala.
Infusoria (9 figures.)	Synchaeta mordax.	Paludicella Ehrenbergi.
Raphidiophrys pallida.	Hydatina senta.	Embryo of Mussel.
Stephanoceros Eichornii.	Rhinops vitrea.	Larva of Corethraplumaticornis
Limnias ceratophylli.	Philodina roseola.	Spawn of Perch.

CONTENTS: FEBRUARY, 1880. No. 2.

VEGETABLE KINGDOM.

Hydrodictyon utriculatum.

ANIMAL KINGDOM.

Spongilla fluviatilis.	Leptodora hyalina.	Carcinus Mænas, in the Zoea
Peridinium tabulatum.	Hyalodaphnia Kahlbergensis,	stage.
Ophrydium versatile.	(Daphnia Bairdii.)	Lophopus crystallinus.
Stentor Barrethi.	Sida crystallina.	Spirobis nautiloides.
Carchesium spectabile.	Diaptomus Castor.	Circulation in Egg of Trout.
Hydra vulgaris.	Cristatella mucedo.	Young Salmon.

CONTENTS: AUGUST, 1880. No. 3.

VEGETABLE KINGDOM.

Draparnaldia glomerata. | Chretophora elegans. | Chara and Nitella. | Chara fragilis embryo

ANIMAL KINGDOM.

Actinosphaerium Eichornii.	Anurea longispina and	Bowerbankia gracillima.
Coleps hirtus.	Ceratium longicorne.	Bosmina longirostris.
Urostyla grandis.	Melicerta ringens.	Larval Shrimp.
Dinobryon spectularia.	Lacinularia socialis.	Nais proboscidea.
Vorticella chlorostigma.	Aleyonella fungosa.	

CONTENTS: FEBRUARY, 1881. No. 4.

VEGETABLE KINGDOM.

Desmids and Diatoms
Æcidium urticae.

Zygnema cruciata.
Vallisneria spiralis.

ANIMAL KINGDOM.

Acineta.	Nassula ornata.	Euchlanis dilatata.
Dendrosoma radians.	Spirostomum teres.	Asellus vulgaris.
Choano-flagellata.	Cordylophora lacustris.	Ilyocypris sordidus.
Bursaria truncatella.	Lucernaria auricula.	Argulus foliaceus.
Marine Infusoria.		

CONTENTS: JUNE, 1881. No. 5.

VEGETABLE KINGDOM.

Protococcus pluvialis.
Vaucheria.

Freshwater algae.
Batrachospermum moniliforme.

ANIMAL KINGDOM.

Ophrydium longipes.	Anguillula glutinis.	Aleyonidium polyomm.
Stentor polymorphus.	Pterodina clypeata.	Bowerbankia imbricata.
Trichodina pediculus.	Gammarus pulex.	Triticeila pedicellata.
Clava squamata.	Caprella lobata.	Pedicellina cernua.
Syncoelyne frutescens.		

Hints on the PRESERVATION OF LIVING OBJECTS and their EXAMINATION UNDER THE MICROSCOPE, by THOMAS BOLTON, F.R.M.S. (Reprinted from the "English Mechanic.") Price Threepence.

March, 1882.]

4b.

[No. 7.

PORTFOLIO OF DRAWINGS,

AND DESCRIPTIONS OF

LIVING ORGANISMS

(ANIMAL AND VEGETABLE),

ILLUSTRATIVE OF

FRESHWATER AND MARINE LIFE,

WHICH HAVE BEEN SENT OUT WITH THE LIVING SPECIMENS BY

THOMAS BOLTON, F.R.M.S.,

57, NEWHALL STREET, BIRMINGHAM.

PRICE ONE SHILLING.

CONTENTS.

VEGETABLE KINGDOM.

Bacteria.	Surirella bifrons.
Asterionella formosa.	Gyrosigma (various).
Spirulina Jenneri.	

ANIMAL KINGDOM.

Trachelomonas bulla.	Ophiocoma neglecta.
Telotrochidium crateriforme.	Tubifex rivulorum.
Amœba.	Floscularia cornuta.
Acineta grandis.	Polyphemus pediculus.
Sertularia pumila.	Canthocamptus minutus.
Aglaophenia pluma.	Doris tuberculata.
Eolis Landsburgii.	

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Bacteria.

The drawing of the various species given on the other side are copied from the plates in the first Vol. of the Journal of Royal Microscopical Society in illustration of a paper by Rev. & W. H. Dallinger. A very good description will be found in Huxley & Martin's Practical Biology, from which the following extract is taken. Under the general title of Bacterium a considerable variety of organisms, for the most part of extreme minuteness, are included. They may be defined as globular, oblong, rod-like or spirally coiled masses of protoplasmic matter enclosed in a more or less distinct structureless substance, devoid of chlorophyll & multiplying by transverse division. The smallest are not more than $\frac{1}{50000}$ th of an inch in diameter, so that under the best microscopes they appear as little more than mere specks, and even the largest have a thickness of little more than $\frac{1}{10000}$ th of an inch, though they may be very long in proportion. Many of them have, like *Protoroccus*, two conditions - a still and an active state. In their still condition, however, they very generally exhibit that Brownian movement which is common to almost all very finely divided solids suspended in a fluid. But this motion is merely oscillatory, & is readily distinguishable from the rapid translation from place to place which is effected by the really active Bacteria." Tho^s. Bolton, 57 Newhall St. Birmingham.

Fig 1.
Bacterium termo.



Fig 2.
Bacterium lincola.



Fig 3. *Bacillus subtilis.*

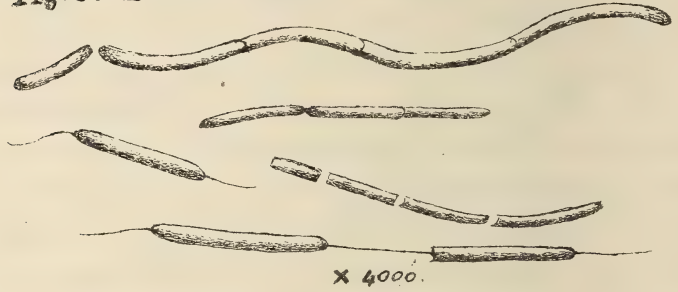


Fig 4. *Vibrio rugula.*



Fig 5.
Spirillum undula.

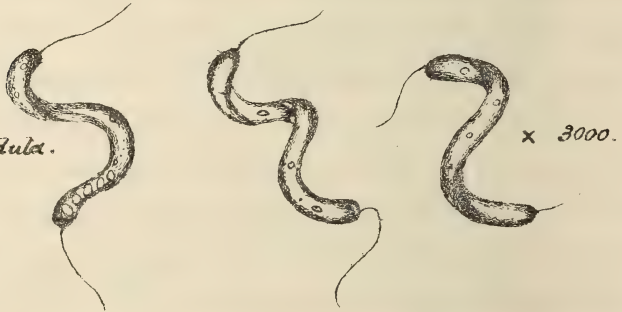


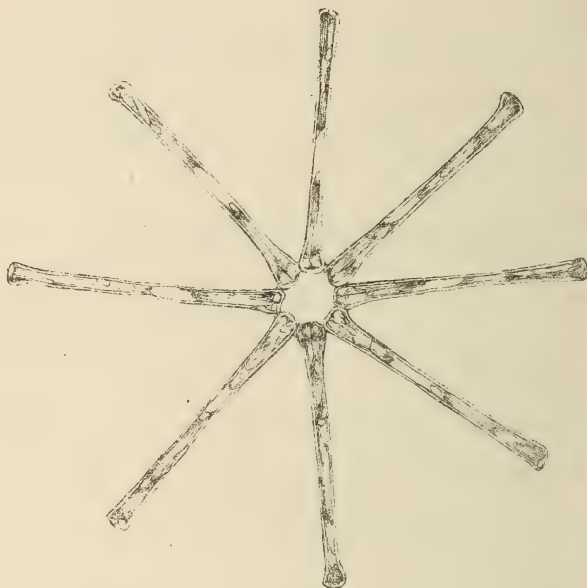
Fig 6. *Spirillum volutans.*



I enclose a very pure gathering of the Diatom
Asterionella formosa collected from a large pool
in Sutton Park. Shake the tube slightly and
place a drop of the water from the lower portion on
a slide and cover with thin glass. Illuminate
strongly with a Wenham Paraboloid and
examine with $\frac{1}{2}$ in. or $\frac{3}{4}$ inch and the groups of
this diatom will stand out like a number of
stars. The delicate frustules of this diatom are
swollen at one end and are attached to each
other by the faceted margins of this swelling so
as to assume a very regular stellate group
with about eight frustules in a complete circle.
They are however not attached in the same
plane, but appear to form a helix, and often
are continued on for a second whorl making
about sixteen radiating frustules to the circle.
These Diatoms were abundant last year in
the Birmingham Town Water, and I expect
will often be found in the drinking water of
other towns. I have a fine engraving of it of
Dr. Hassall's amongst a group of organisms
found in water from the Grand Junction Co. (from
a cistern) in London.

Thos. Bolton, 57, Newhall St. Birmingham. Oct 7th 1881

× 450.



J. del.

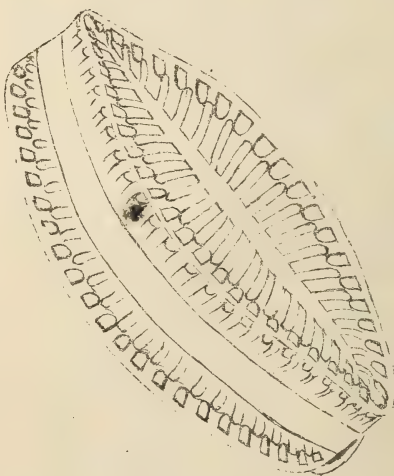
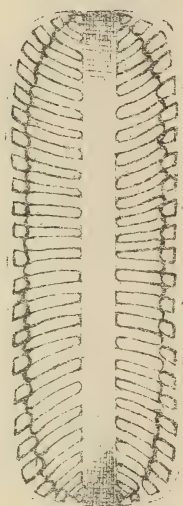
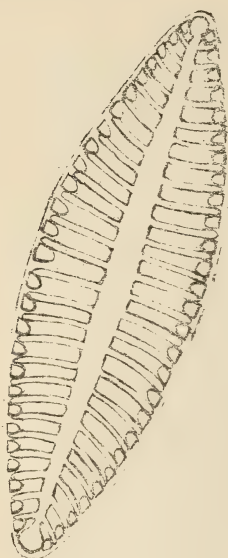
ASTERIONELLA FORMOSA.

Pirella bifrons.

This genus of *Diatomaceae* is described by Smith as follows. - Frustules simple, free; margin striated; lateral surfaces broader than the front view with a smooth median longitudinal line; margins produced into alae, canaliculi distinct, usually parallel. The characters of the species *P. bifrons* (Syn. *P. biseriata*). - Front view quadrate lateral, with conspicuous alae; lateral view oblong-lanceolate, with broad costae, which usually reach the median line. Differs from *P. splendida* by its parallel sides in front view. Its angles are rounded, and the alae enclose an oblong space; its costae are conspicuous in both views. 1-210" to 1.100". Thrice 34.
This interesting diatom I found in abundance amongst some sphagnum with a variety of other diatoms and desmids at Sutton.

It is a good example in which to study the much debated question of the cause of movement of the frustules whether from osmosis or from the action of cilia. With this example before them I would advise my correspondents to read Mr. Cox's paper on Motion of Diatoms in the Northern Microscopist of August last, and Mr. Duby's on the Appearances of their Valves in the September number.

Thos. Bolton, 57, Newhall St. Birmingham.

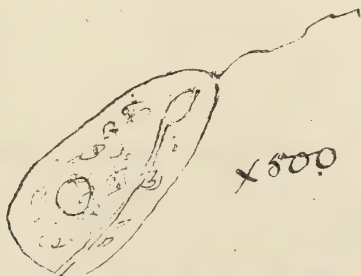


M. del.

SURIRELLA BIFRONS.

Marine Diatoms

This very choice collection contains many specimens of the various species figured on the other side besides other species. They are very active and well adapted for the study of the minute point as to the cause of their motion. They will well repay an examination with the very highest power available. The markings of the frustule are during life much masked by the intercellular chlorophyll, which is best illuminated by heating a portion to redness whilst placed on a thin cover glass supported on the flame of a Bunsen burner on a bit of Platinum foil. With the Diatoms are some interesting biflagellate Monads as figured below. The one flagellum is nearly twice the length of the Monad, and is used as a kind of trailing line by which it anchors itself to any surface and the other shorter flagellum is used for locomotion.



Thomas Bolton, 57 Newhall St. Birmingham.

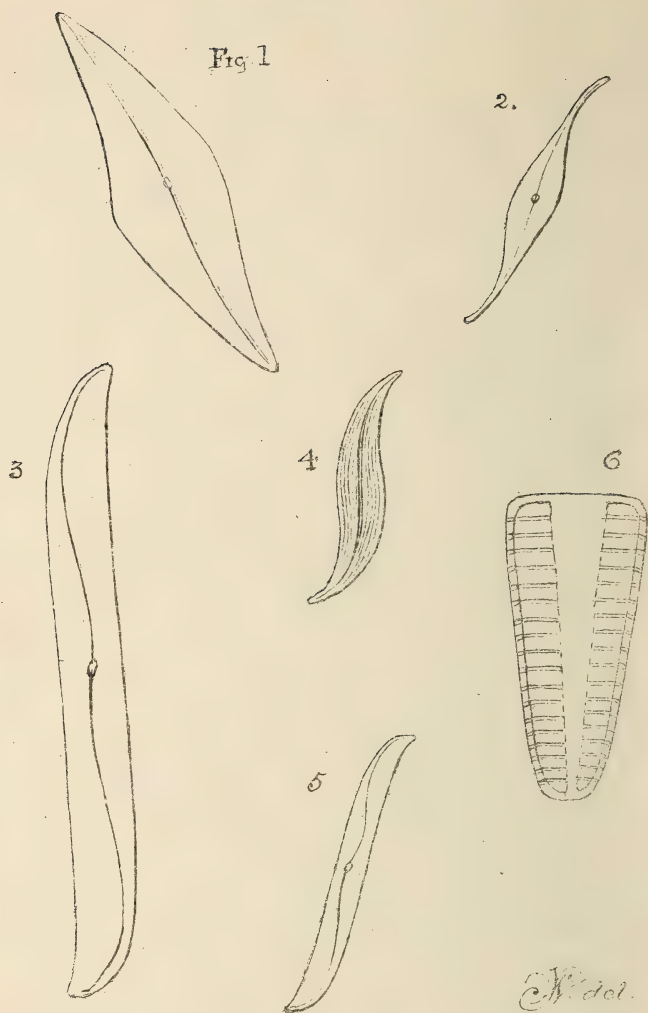


Fig 1.	Gyrosigma	angulatum.	side view
2.	G.	fasciola.	"
3.	G.	speciosum.	"
4.	G.	littorale.	"
5.	G.	obscurum.	"
6.	Surirella	gemma.	front



Spirulina jenneri.

A species of the family Oscillatoriaceæ
belonging to the Conferoid Algae.

It consists of a minute spirally coiled
filament 1-6000 in diameter usually of
eight or ten coils, immersed in a gelatinous
matrix. These filaments have a slight
oscillating motion. They occur in lakes
and pools, and in such numbers that
they form a regular stratum of an
olive green colour. Their intimate
structure and development are not well
understood, but they are believed to
multiply by breaking across.

The Botton 54, Newhall St. Birmingham



TRACHELOMONAS BULLA.

Trachelomonas.—Animalcules monoflagellate, plastic and changeable in form, enclosed within a free-floating, ovate or spheroidal, indurated sheath or lorica, the anterior extremity of the lorica perforated by a minute aperture, through which in its normal condition the single flagellum only is protruded, oral aperture terminal, followed by a distinct pharyngeal passage endoplasm coloured green, with usually a red pigment-spot at the anterior extremity; contractile vesicle single, spherical, located near the anterior pigment-spot. Mostly inhabiting fresh water.

Trachelomonas bulla.—Lorica elongate-ovate, from two and a half to three times as long as broad, produced anteriorly into a conical, neck-like prolongation; the surface entirely smooth or beset with minute hispid points which are both finer and less thickly distributed than in *T. hispida* & *T. caudata*. Length 1.500" to 1.430. Hab.—Fresh water.

(W. Saville Kent's Manual of the Infusoria.)
 Thos Bolton, 57, Newhall St. Birmingham.

GENUS TELOTROCHIDIUM, S. K.

(*Telotrocha*, worm-larva; *eidos*, form.)

Animalcules entirely free-swimming, ovate or campanulate, possessing no caudal appendage; ciliary girdles two in number; oral aperture opening on the ventral surface, immediately behind the anterior wreath of cilia; anal aperture postero-terminal; contractile vesicle and endoplast conspicuously developed. Increasing by longitudinal fission. Inhabiting fresh water.

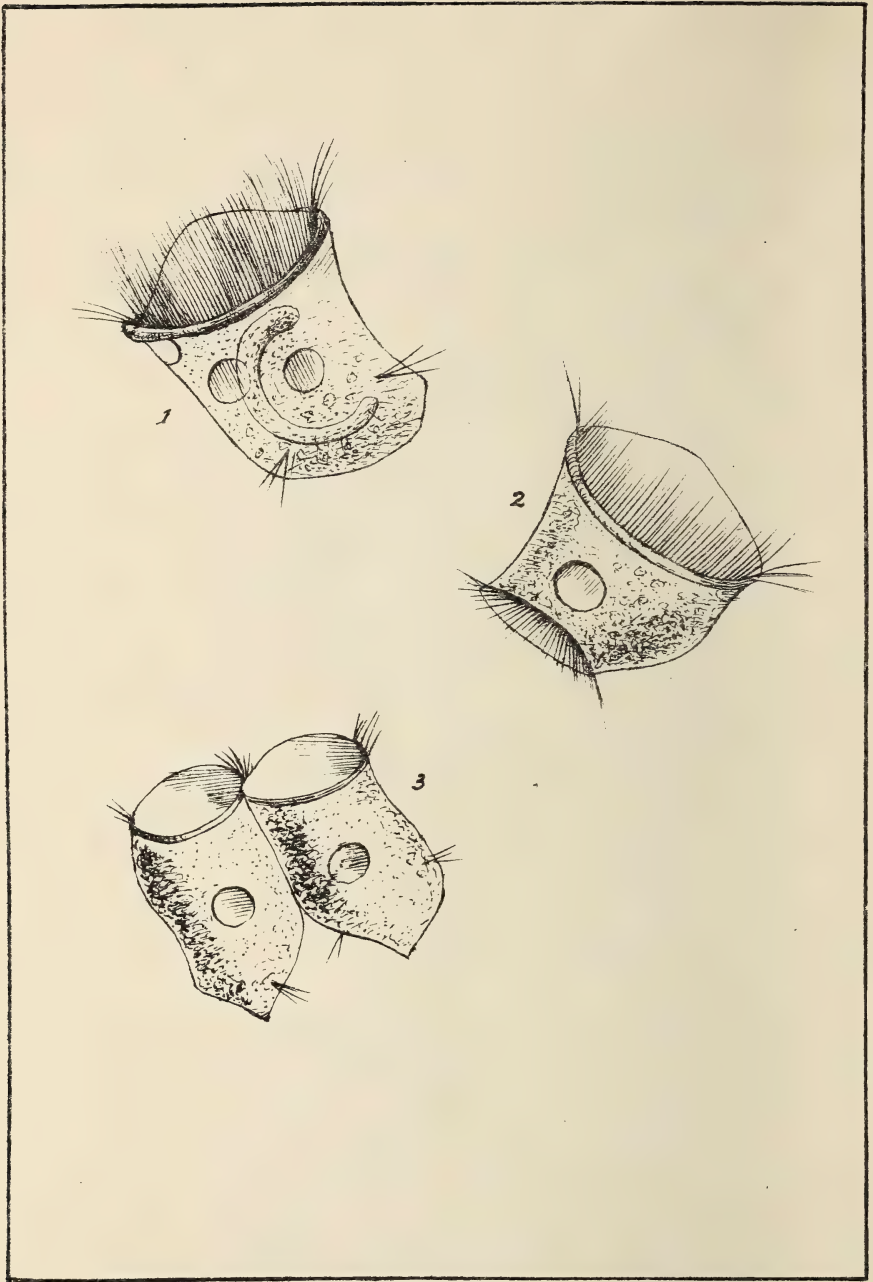
TELOTROCHIDIUM CRATERIFORME, Müller, sp.

Body campanulate or subquadrate, with an indented dorsal and convex ventral or oral aspect; ciliary wreaths developed at a short distance only from the anterior and posterior extremities, the anterior one associated with a thick annular border; anal aperture postero-terminal, tubular, permanently visible; contractile vesicle, single or double, sub-central; endoplast band-like, curved; parenchyma transparent, pale brown or amber-coloured. Movements swift, rotating in alternate directions. Length 1-250 μ . Hab. Pond water.

Examples of this species were abundantly developed in a sample of water containing *Euglena acus* and *Distigma proteus*, remitted to the author by Mr. Thos. Bolton in November, 1880. While at first sight presenting no inconsiderable resemblance to detached *Vorticella*, the recognition, on a more intimate acquaintance of the posterior location and conspicuous development of the anal apertures from which the passage of excreta was directly observed, together with the character of the oral system, speedily indicated the necessity of assigning to this type a position altogether independent of the *Vorticellidæ*. Excepting, indeed, for the absence of an adherent caudal appendage, it in many respects agrees with *Urocentrum*, and may be most conveniently referred to that family group. The likeness suggested is manifested, in addition to the number and position of the ciliary girdles and ventral location of the oral aperture, in the texture and pale-brownish hue of the parenchyma, and in its mode of locomotion. This, while accomplished in a forward direction, is accompanied by the rotation of the animalcule in alternate directions, a slight displacement of the generated force being alone required to convert it into that oscillating or pendulum-like motion so highly characteristic of *Urocentrum*. While in most instances a single sub-central contractile vesicle was alone to be detected, some few examples occurred in which, as shown at Fig. 1, two such structures were distinctly developed. It would seem, however, to be by no means improbable that such zooids were about to multiply by the process of fission, which, contrary to that of *Urocentrum*, takes a longitudinal direction. It was remarked that the animalcules varied very considerably among each other in their relative lengths and in the contour of the posterior region. While more ordinarily the length nearly equalled twice the breadth, the posterior extremity being in such case rounded or obtusely pointed, examples were not unfrequently met with whose length did not surpass more than one-half of the breadth, and the posterior extremity being abruptly truncate, the body as a whole presented, as shown at Fig. 2, a short discoidal contour. Although the anterior ciliary wreath, with its thickened border, was in all instances distinctly recognisable, the simple and smaller posterior girdle was not so clearly perceived, and more often, indeed, presented the aspect only of a few lateral setose appendages. At the end of a week's preservation in the living state all the specimens received affixed themselves to the sides of the glass zoophyte trough to which they had been transferred, and speedily entered upon the encysted state. The band-like endoplast became sub-divided into nodular fragments, but further developmental phases were not observed. The remarkable homoplastic resemblance that subsists between the animalcules of this species and the so-called telotrochous larvæ of certain Annelids, and which has suggested the generic title here conferred upon it, is referred to, with an accompanying illustration, at pages 447 and 478 of the previous volume.

(From W. Saville Kent's *Manual*, Part V., page 643.)

THOS. BOLTON, 57, NEWHALL STREET, BIRMINGHAM.



Telotrochidium crateriforme.

I am often called upon to supply specimens of *Amoeba* to students who are not conversant with this organism so I have drawn up the following directions as to the best way to look for and examine them. Allow the tube containing the *Amoeba* material to remain some time at rest. With a dipping tube draw up a little from the surface of the sediment. Hold the dipping tube now over the centre of a glass slide, allowing some of the sediment gradually to fall upon it. Then cover with a very thin glass & remove excess of water. It is now again better to allow it some rest for the *Amoeba* to creep out on the surface of the glass from amongst the dirt. Place in the microscope and examine with a 4 inch objective, very carefully illuminating with an achromatic condenser.

The illumination is all important, a good fairly bright illumination but not glaring. Focus carefully for the dirt and other objects lying on the surface of the glass slide under the cover and systematically go over the whole surface. The *Amoeba* should be seen as in the drawing like a little jelly of irregular contour with very definite bordering line within which it is quite hyaline, with central mass of granular matter. The characteristic movement of the Pseudopodia will soon be seen pushing out in various directions followed up with jerks by the more solid protoplasm. A little gentle warmth promotes the activity of the *Amoeba*.

Thos Bolton. 57 Newhall St Birmingham.

Fig. 1.



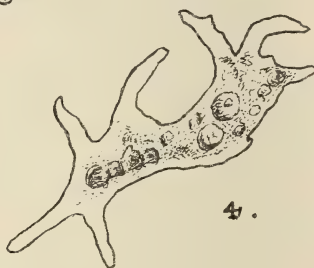
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W. del.

Fig 1. AMŒBA VILLOSA.
Figs 2,3 and 4 forms of A. PRINCEPS.
(after Professor J. Martin Duncan FRS.)

ACINETA GRANDIS. S. K.

Lorica, sub-triangular, compressed, widest at the anterior border, tapering gradually towards the posterior extremity, not subdivided by membranous septa into separate compartments; pedicle, slender rectilinear, three or four times the length of the lorica; enclosed animalcule ovate or elliptical, usually occupying the anterior half, or even a less considerable area of the cavity of the lorica; tentacles distinctly capitate, forming two lateral bundles; contractile vesicle spherical, subcentral; endoplast band-like, rendered conspicuously visible only by the action of reagents; parenchyma transparent finely granular. Length of lorica 1-100 to 1-75. Hab.: Birmingham and Stratford Canal, on Nitella Anacharis, and Potamogeton.

Examples of this new and handsome species have been remitted to the author in November of the two consecutive years 1880 and 1881, by Mr. Thos. Bolton, of Birmingham. While at first sight it would appear to differ but little, except in size, from the respective salt and freshwater forms *Acineta tuberosa* and *A. lemnae* it is found on closer inspection to yield many distinctive features. The lorica in the first place has a much more simple structure, being devoid of those delicate perpendicular membranous septa which in the two preceding types seem to compress the posterior region of the body into a quadrilateral contour. Neither again is the anterior border of the lorica arched over by a continuation of its lateral walls, leaving slit-like apertures only for the extrusion of the tentacles, as obtains in these two forms. The body of the animalcule is of a much less relative size, it usually occupying, as shown in the accompanying figures, scarcely one-half of the cavity of its protective sheath. The comparatively colossal dimensions of this species as compared with its homotype, *Acineta lemnae*, found growing close beside it, is well illustrated in the same drawing, and where at *b* an outline of the more familiar but smaller species has been added for the purpose of comparison. Although the form and position of the nucleus or endoplast was not readily detected in living specimens, this structure was rendered distinctly visible in examples killed with osmic acid, and then treated with picro-carmin.

I am glad to be able to send out specimens of this new species to my subscribers, together with the above description, with which I am favoured by Mr. W. Saville Kent, who has prepared it for insertion in his new manual of the Infusoria, of which the sixth and concluding part will shortly be published.

THOMAS BOLTON,

57, NEWHALL STREET, BIRMINGHAM.



ACINETA GRANDIS, S.K.

Sertularia pumila.

"Every one must have seen this pretty little object which goes by the popular name of the 'Sea-oak Coralline'." It is of a greenish colour, & occurs in considerable abundance in the common serrated wrack. Indeed, the latter is often invested with such a quantity of it as almost to have its fronds weighed down with it.

The illustration will easily convey an idea of how this little zoophyte clings to seaweeds, and also give a good notion of what it is like. The shoots are seldom more than half an inch in height, and are threadlike, and very sparingly branched. The hydras inhabiting the cells or calyces, when examined with a strong magnifying glass, are seen to possess 14 to 16 tentacles. When these are displayed the hydra usually extrudes its body far beyond the rim of the cell. It may be this particular species which Crabbe the poet had in view when he wrote -

"Involved in sea-wrack, here you find a race,
Which science, doubting, knows not where to place."
Since the poet saw it growing in abundance along the Suffolk shore, science has found out exactly where to place it, and the due zoological value attached to each function in the biological scale." (from Taylor's Half-hours at the Seaside.)
Thos. Bolton, 51 Newhall St. Birmingham. Oct: 31/81.



W. del.

SERTULARIA PUMILA .

Aglaophenia pluma.

The Poddied Coralline of Ellis. One of the Marine Hydrozoa. Generic character.—Shoots plumose, simple or branched, rooted by a filiform stolon; hydrothecæ cup-shaped or tubulous; nematophores only developed in connexion with the hydrothecæ, two lateral and one anterior; gonothecæ collected in corbulæ, or borne singly near the base of the pinnae. Specific character.—Stem recurved, smooth, dark brown; pinnae alternate, simple, one to each internode, approximate, springing from the front of the stem; Hydrothecæ cup-shaped, expanding above, aperture patulous, with a strongly denticulated and somewhat everted margin; Nematophores tubular, channelled, the lateral small and not projecting much; the anterior stout, adnate through great part of its length, free at the extremity, which projects but slightly; Gonothecæ oviform, protected by a pod-shaped receptacle, formed by the union of a number of crested ribs, and occupying the place of a pinna.
(Stencher's Hydrozoa.)

Thos Bolton, 57 Newhall St. Birmingham.



J. del.

AGLAOPHENIA PLUMA

Ophiocoma neglecta.

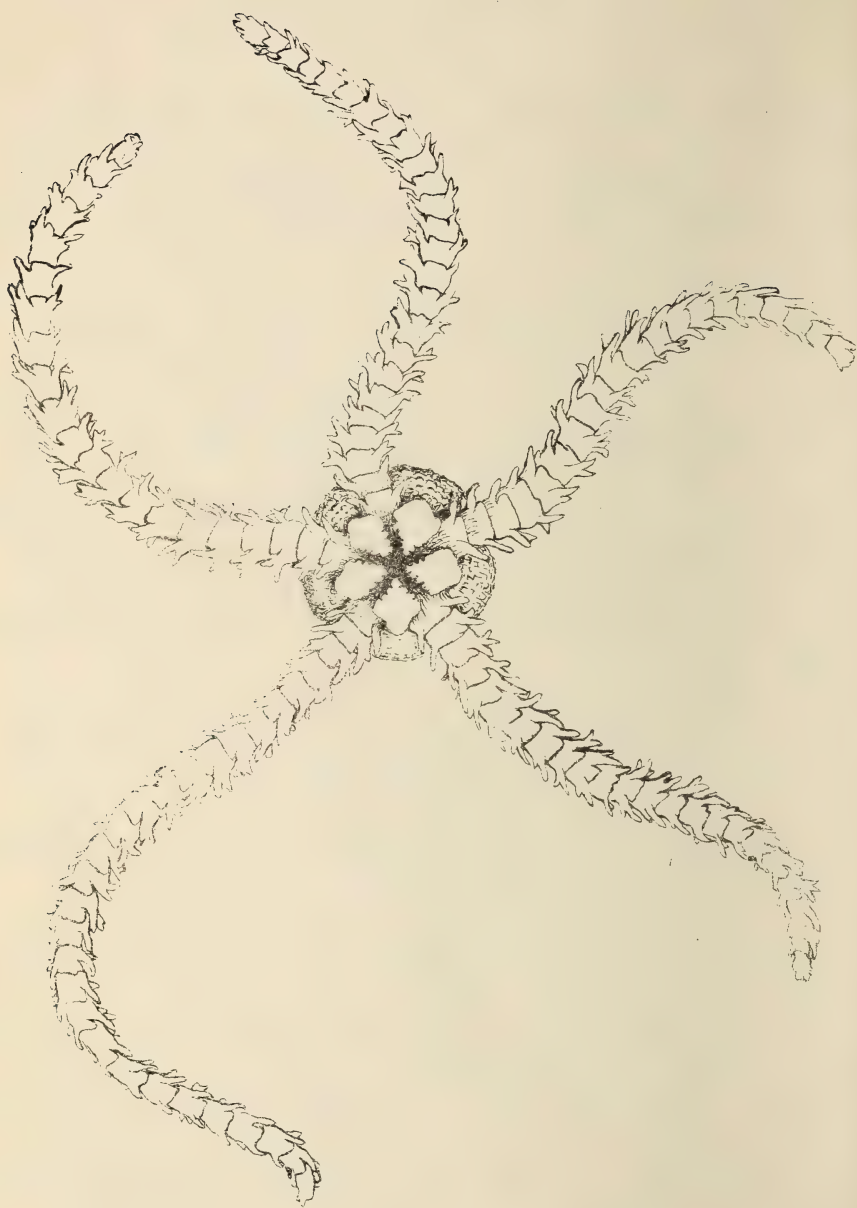
or Gray Brittle-Star

Generic Character.- Rays simple, squamose, not prolonged into the disk superiorly, and separated at their origins beneath by small pentangular plates.

Specific Character.- Disk round, flat, imbricated with small smooth scales. Two oblong, parallel, touching plates opposite the origin of each ray. Upper ray scales square; lateral ray-plates, bearing four or five spines each, which are equal in length to the breadth of the ray.

The drawing shows the curious mouth, on the under side. The Brittle-stars are at once recognized as distinct from the true Ophiure, (Sand-Stars), either alive or dried, by their peculiar habit, as well as by minute but more easily definable characters. The rays of the Sand-stars have a whip-like or lizard-tail appearance, those of the Brittle-stars look like so many Centipedes or Annelides, attached at regular distances round a little Sea-urchin.

Thos Bolton, 54 Newhall St. Birmingham. Nov^r 11/81.



OPHIOCOMA NEGLECTA.

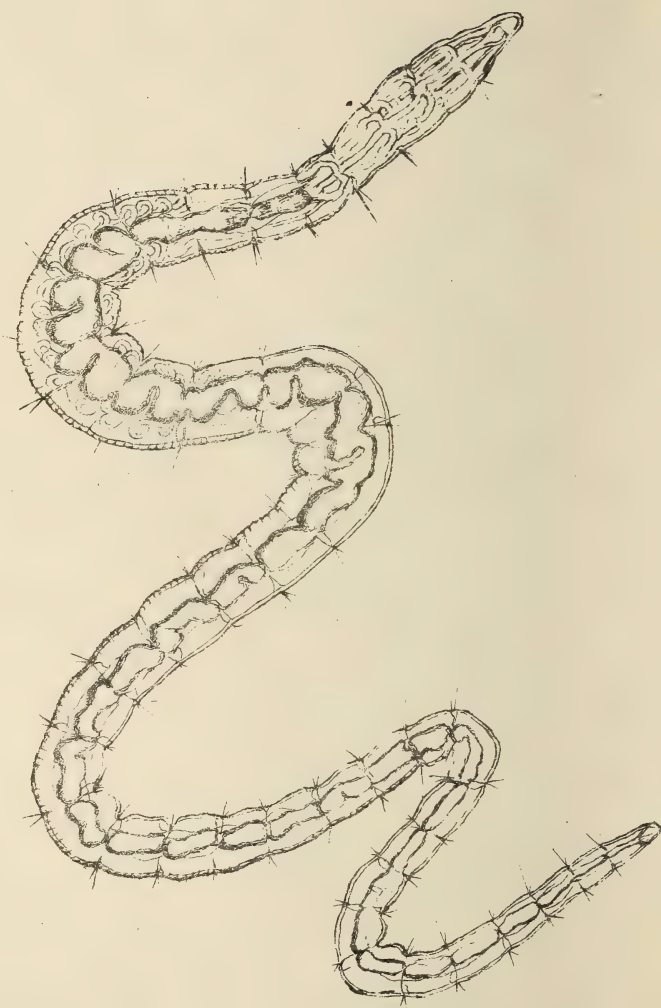
W. de?

Tubifex rivulorum.

A careful examination under the microscope of this common mud worm will be found of considerable interest, as its transparency enables the student to follow the blood-vessels, alimentary system, nerves, and reproductive organs which are all very fully described in a paper by Prof. E. Ray Lankester in the Popular Science Review 1863. Much of the description of the anatomy of the Common Earth Worm in Mr. Darwin's new book is applicable to this also.

Prof. E. Ray Lankester says.—*Tubifex rivulorum* (the River *Tubifex*), for so it has been called by the eminent naturalist Lamarck, belongs to the family of Lumbricidae, or Earthworms, and the subfamily Naiadidae, or water-worms, according to some naturalists (for they burrow in the mud of rivers), whilst others rank it amongst the "Tetigeræ", or bristled worms (in consequence of its being furnished with two lateral rows of bristles), but in the same group, Lumbricidae or Lumbricini. It is from half an inch, to an inch and a half long, and is attenuated at each end.

Thos. Bolton, 57 Newhall St. Birmingham.



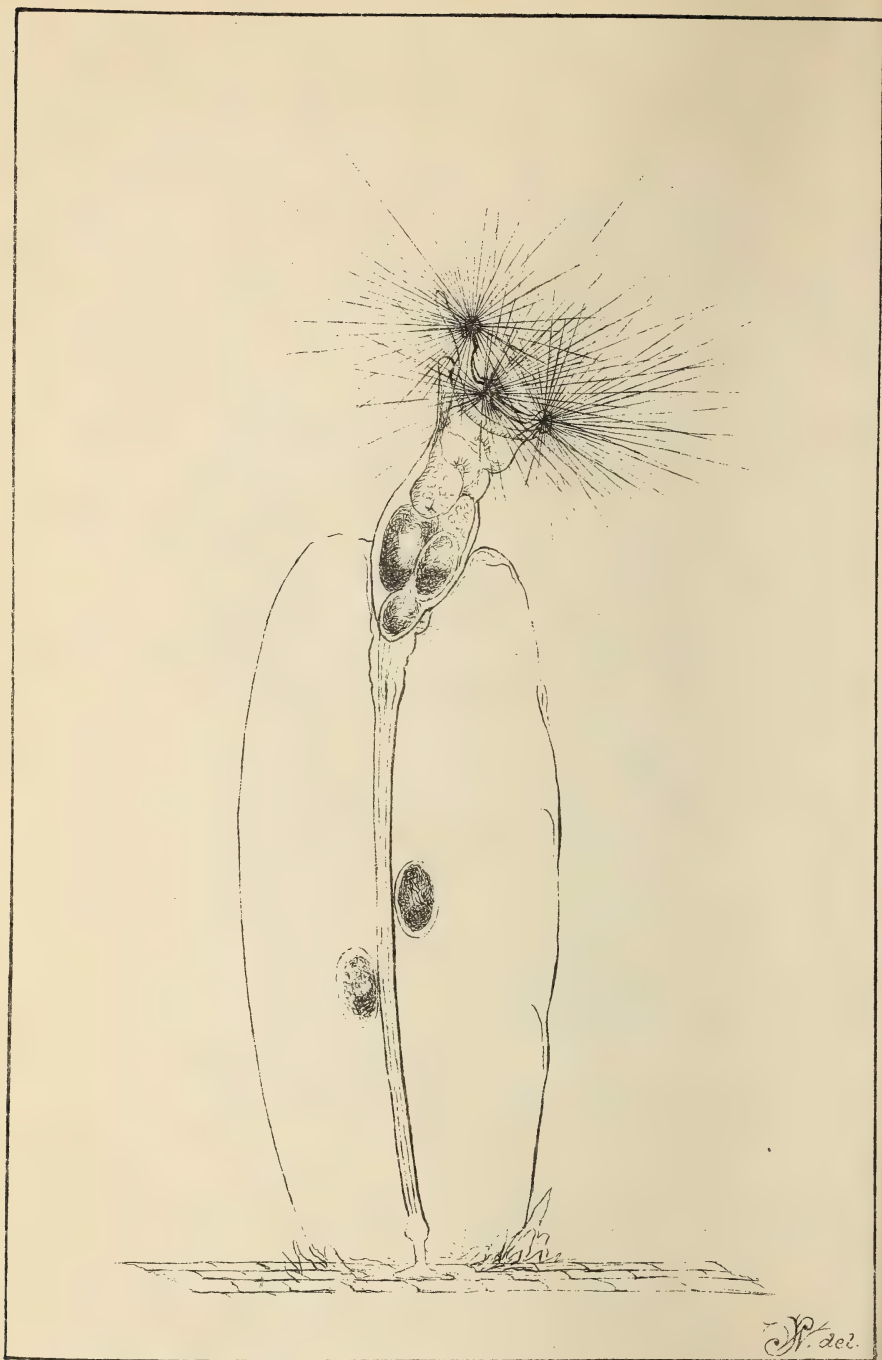
W. del.

TUBIFEX RIVULORUM.

Floscularia cornuta.

This genus is one of exquisite delicacy. It is far inferior in size to *Strophoceros* and cannot compete with it in majesty of form, but it, perhaps, surpasses that fine species in elegance and grace. It may be compared to a long tubular flower, with a five-angled tube somewhat like that of a convolvulus the tube swollen, and contracted below the lip, and seated on the end of a long stalk. A glance at the figure will, however, give a more exact idea of the graceful animal than this comparison, which yet has sufficient resemblance to have obtained for it more than one scientific appellation; - Pallas having given to the species the name of *Hyacinthinus*, and which name (*Porticella hyacinthinus*) it takes its place in the edition of Linnæus's *Systema Naturæ*, and Chen making in 1815 a new of it by its now accepted title of *Floscularia*, from *flosculus*, little flower. - The body is oval, sometimes very regularly, but at other times, a little enlarging at the upper end. Above this there is a restriction or neck, but not so well defined a collar as in *Strophoceros*, from this neck the beautiful flower-like disk opens, an expanse of a most exquisitely delicate and brilliantly transparent membrane, which, as I have said, forms five blunt points, equidistant, & somewhat rising, so as to give a trumpet-like contour to the outline. One of the angular projections of the disk is considerably higher than the rest, and this is the dorsal one; so that the plane of the five knobs is not horizontal, but oblique, facing forwards. A very remarkable feature in the animal, and one to which it owes much of its peculiar elegance, is that each knob is beset with straight bristles, of exceeding tenderness, and of great length, which are not set in one plane, but radiate in every direction. Ehrenberg says, there are from 5 to 8 on each angle, but probably the poverty of his instrument deceived him. I have counted from 40 to 50 on one knob. When the animal retracts, all the bristles are drawn parallel into a single pencil, & concealed within the body; & this arrangement is well seen as they partly protrude, in the act of eversion. They are motionless when expanded, but while protruding, & in the instant of expanding falling, as Mr. Hask well says, on all sides in a graceful shower. The pencil is seen to be agitated with a close & rapid thrill or wave, which runs along it, & looks much like the flickering of a candle-flame. It ceases the instant the disk is expanded. In *cornuta* from the back of this prominent dorsal knob arises the horn, characteristic of this species. From *Gosse* - *Popular Science Review* 1862.

Theo. Bolton, 57, Newhall St. Birmingham Oct 7 25th 1851.



FLOSCULARIA CORNUTA.

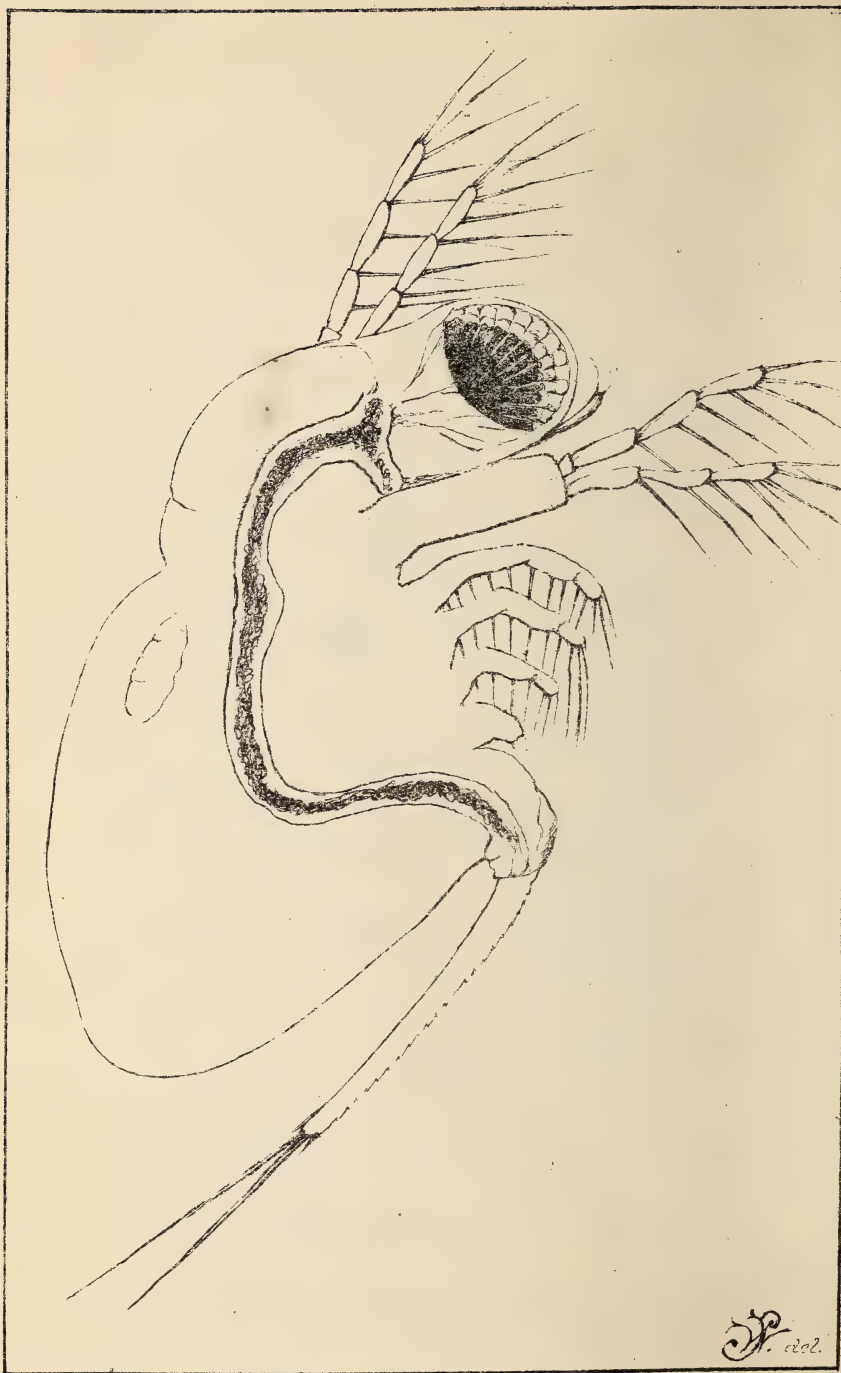
Polyphemus pediculus.

Head distinct from body. Abdomen long, projecting externally from the shell.

The body is oval-shaped, separated from the head by a deep indentation. The upper part of the head is almost entirely occupied with the eye, which is provided with its rotatory muscles, as in the Daphniadæ, and is beset, all round the upper and outer edges, with numerous lucid areolæ, about 20 in number. The lower part is quite transparent, the black mass filling only about three fourths of the whole. It is very difficult to make accurate observations on the manners & habits of living and propagating their species in this genus, as the little animals are very difficult to be kept in captivity. In the young, even when in the matrix, it is particularly observable, that the eye very soon makes its appearance, an organ so large in the adult, that Müller says "its head is all eye." The males have never yet been noticed by any observer.

(Baird's Entomostraca.)

Thos. Bolton, 57 Newhall St. Birmingham.



POLYPHEMUS PEDICULUS.

Doris tuberculata.

The sea-lemon. The body 2 or 3 inches long, breadth about half the length; of an elliptical form, nearly equally rounded at both ends. The colour is generally a lemon-yellow or buff-orange; but it is frequently variegated on the upper side with blotches of sage-green, pink, and grayish brown. It sometimes occurs of a very light sage colour, almost white, and young individuals may be procured quite white. The markings are also very variable: occasionally they are numerous and large, covering a great portion of the cloak; at other times they are small, distant, and irregular spots. Full yellow specimens are commonly seen without any markings. Cloak thickly covered with flattish, spiculate, unequal, tubercles, the smaller ones being very numerous and much less than the others; it extends considerably beyond the foot, and has the margins rather thickish; the under side is smooth.

Dorsal tentacles slightly conical, yellow, & strongly laminated above, smooth, transparent, and nearly colourless below. The laminae are upwards of 20, alternately large & small; the latter not extending so far forwards as the former. Branchial plumes nine, tripinnate, recurved, large and spreading; much undulated in outline, and forming an incomplete circle round the anus, open behind. Head rather small, with two small tubercular oral tentacles. Foot broadish, rounded & grooved in front, tip broadly rounded behind, & of a lemon-yellow or orange colour, with the liver appearing through the centre.

Thos Bolton, 57 Newhall St. Birmingham.



Doris tuberculata. The Sea Lemon.

Canthocamptus minutus.

Foot-jaws small, simple. Antennules simple.
Ovary single. The thorax & abdomen are not distinctly separated from each other. They are composed of 10 segments, which gradually diminish in size as they descend. The first consolidated with the head, is the largest, & the last one terminates in two short lobes, from which issue two long filaments, slightly serrated on their edges. At the junction of the fifth with the fourth articulation, the body is very moveable, & the animal frequently turns up the posterior extremity upon the anterior, in the manner of the kind of beetle called *Staphylinus*. At the base of the sixth ring in the female are the openings of the canalis deferens, & under the 6th & 7th segments the adults of the same sex carry a very singular, horny-looking, club-shaped organ, which is fastened to the body by a narrow, elongated stalk. It is somewhat curved, & directed backwards; its colour being almost always more or less of a red hue. This organ is not found in the young female, nor till after she has several times laid eggs. Its hardness is greater than that of the shell or carapace of the animal. Jurine has seen 2 in one female, one red, the other black. Its use is unknown. (Baird's Entomostraca)

Thos. Bolton, 54 Newhall St. Birmingham.



J. del.

CANTHOCAMPTUS MINUTUS.

Eolis Landsburgii.

This beautiful little Nadibranchiate Mollusca or sea-slug is thus described in Alder & Hancock's Monograph published by the Ray Society.

Body half an inch long, very slender & of a beautiful violet or amethyst colour. Dorsal tentacles moderately long slender linear, violet tipped with yellowish white. They are set a little apart at the base; the tips widely separated, and not much inclined forwards. The eyes are placed rather far behind them.

Oral tentacles a little longer than the dorsal pair, and of the same colour: they form a continuous outline with the sides of the head, as in *Eolis coronata*. Branchiae rather short and stout, nearly linear or slightly elliptical; the central gland of an orange red, not granular; the sheaths rather wide, pale, transparent violet, with a ring of white at the apices. They are set down the sides of the back in 5 or 6 clusters: the first containing from 8 to 12 papillae; the second from 6 to 9; and the others fewer, as they approach the tail. Foot of a yellowish hue down the centre, with the margins of a pale violet; very narrow, arched in front, with the lateral angles acute, but not much produced; terminating in a fine point behind, a little way beyond the branchiae. Mouth very small and nearly circular. The lingual plate has a strong central, with two separate, lateral, denticulated spines.

Thos. Bolton 54 Newhall St. Birmingham.



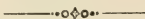
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Acineta.	Marine Infusoria.	Euchlanis dilatata.
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VEGETABLE KINGDOM.

Protoecoccus pluvialis. | Vaucheria. | Freshwater algae. | Batrachospermum moniliforme.

ANIMAL KINGDOM.

Ophrydium longipes.	Syncoryne frutescens.	Aleyonidium polyomm.
Stentor polymorphus.	Anguillula glutinis.	Bowerbankia imbricata.
Trichodina pediculus.	Pterodina clypeata.	Triticella pedicellata.
Clava squamata.	Gammarus pulex.	Pedicellina cernua.
	Caprella lobata.	

CONTENTS : SEPTEMBER, 1881. No. 6.

VEGETABLE KINGDOM.

Bacillaria paradoxa.

ANIMAL KINGDOM.

Triloculina trigonula.	Clytia Johnstoni.	Rotifer macrurus.
Noctiluca miliaris.	Medusiform gonozoid.	Daphnia pulex.
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- | | |
|--------------------------|----------------------------|
| - Loxophyllum meleagris. | - Floscularia campanulata. |
| - Condyllostoma patens. | - Floscularia trifolium. |
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- Sep. 13. *Lacinularia socialis*
 " 20. *Cristatella mucedo*
 " 27. *Limnias ceratophylli*, with *Melicerta*
 ringens
 Oct. 4. *Stephanoceros Eichornii*
 " 11. *Plumatella repens*
 " 18. *Stentor polymorphus*
 " 25. *Philodina roseola*
 Nov. 1. *Olosterium lunula*
 " 8. *Spongilla fluviatilis*
 " 15. *Floscularia campanulata*
 " 22. " *cornuta*
 " 26. *Hydatina senta*
 Dec. 6. Larval Form (Trochosphere) of Marine
 Polyzoa (*Alcyonidium*)
 " 13. Marine *Polyzoa*
 " 20. *Raphidiophrys pallida*
 " 27. *Volvox globator*

1879.

- Jan. 3. *Euglena viridis*
 " 10. *Loxophyllum meleagris*
 " 17. Spawn of Trout
 " 24. *Ceistes crystallinus*
 " 31. *Infusoria*
 Feb. 7. *Ceistes*, with other Rotifers
 " 14. Young Trout, (Alevin stage)
 " 21. *Spirostomum ambiguum*
 " 28. *Rhinops vitrea*
 Mar. 7. *Euglena* and *Hydatina*
 " 14. *Plumatella repens*
 " 21. *Spongilla fluviatilis*
 " 28. *Cristatella mucedo*
 April 4. *Synchaeta pectinata*
 " 11. Embryo of Mussel
 " 18. *Nitella translucens*, with *Carchesium*
 polypinum
 " 25. *Batrachospermum moniliforme*
 May 2. Elver (young Eel)
 " 9. Spawn of Perch
 " 16. *Pandorina morum*
 " 23. *Fredericella sultana*
 " 30. *Brachionus pala*
 June 6. *Uroglana volvox*
 " 13. Larva of *Corethra plumicornis*
 " 20. *Asplanchna Brightwellii*
 " 27. *Floscules*
 July 4. *Gonium pectorale*
 " 11. Marine objects (various)
 " 18. *Nostoc commune*
 " 22. *Volvox* and *Plumatella*
 Aug. 1. *Leptodora hyalina*
 " 8. *Hyalodaphnia Kahlbergensis*
 " 15. *Kondylostoma patens*
 " 22. *Vaucheria*
 " 29. *Conochilus volvox*
 Sep. 5. *Brachionus urceolaris*
 " 12. *Sida crystallina*
 " 19. *Lacinularia socialis*
 " 26. *Vorticellidae*
 Oct. 3. *Stentor Mulleri*
 " 10. *Diaptomus castor*
 " 17. *Hydra vulgaris*
 " 24. *Bosmina longirostris*
 " 31. Rotifers (various)
 Nov. 7. Weeds incrustated with Rotifers and Infusoria
 " 14. *Ophrydium versatile*
 " 21. *Hydrodictyon utriculatum*
 " 28. *Peridinium tabulatum*
 Dec. 5. *Draparnaldia glomerata*
 " 12. *Stentor Barretti*
 " 19. *Lophopus crystallinus*
 " 26. *Spiroboris nautiloides*

1880.

- Jan. 2. *Canthocamptus furcatus*
 " 9. Zoa of Crab
 " 16. Spawn of Trout
 " 23. *Acineta mystacina*
 " 30. *Urostyla grandis*
 Feb. 6. Spawn of Char
 " 13. *Synchaeta tremula*

1880.

- Feb. 20. *Zoothamnium*
 " 27. *Rhinops vitrea*
 Mar. 5. *Coleps hirtus*
 " 12. *Nitella Embryo*
 " 19. *Dinobryon sertularia*
 " 26. Glass Larva
 April 2. *Chaetophora elegans*
 " 9. *Asplanchna Brightwellii*
 " 16. Spawn of Perch
 " 23. *Zygnema cruciata*
 " 30. *Brachionus* on *Daphnia*
 May 7. Elver or young Eel
 " 14. *Conochilus volvox*
 " 21. Larval Shrimp
 " 28. *Bosmina longirostris*
 June 4. *Melicerta ringens*
 " 11. *Anuræa longispina*
 " 18. *Hyalodaphnia Kahlbergensis*
 " 25. *Leptodora hyalina*
 July 2. *Vorticella chlorostigma*
 " 9. *Paludicella Ehrenbergi*
 " 9. *Nais proboscidea*
 " 23. *Spirulina oscillarioides*
 " 30. *Protocecus pluvialis*
 Aug. 6. *Alcyonella fungosa*
 " 13. *Argulus foliaceus*
 " 20. *Edogonium ciliatum*
 " 27. *Epistylis plicatilis*
 Sep. 3. *Daphnia pulex*
 " 10. Bugula avicularia
 " 17. *Nassula ornata*
 " 24. *Clava squamata*
 Oct. 1. *Melicerta* and *Floscules*
 " 8. *Cordylophora lacustris*
 " 15. *Colpidium cucullus*
 " 22. *Pedicellina cernua*
 " 29. Rotifers (various)
 Nov. 5. *Choano-flagellata*
 " 12. *Acineta mystacina*
 " 19. Trochospheres of *Polyzoa*
 " 26. Desmids and Diatoms
 Dec. 3. *Spirostomum teres*
 " 10. *Distigma proteus*
 " 17. *Asellus vulgaris*
 " 23. Ova of *Salmo fontinalis*
 " 31. *Follicularia ampulla*

1881.

- Jan. 7. *Bursaria truncatella*
 " 14. *Pterodina clypeata*
 " 21. *Spiroboris nautiloides*
 " 28. *Argulus foliaceus*
 Feb. 4. *Anguillula glutinis*
 " 11. *Opercularia nutans*
 " 18. Trout Fry
 " 25. *Glochidia* (spawn of Mussel)
 Mar. 4. *Batrachospermum moniliforme*
 " 11. *Paramecia aurelia*
 " 18. Salmon Fry
 " 25. *Bowerbankia imbricata*
 April 1. Rotifers (free swimming)
 " 8. *Stentor polymorphus*
 " 14. *Trichodina pediculus*
 " 22. *Gammarus pulex*
 " 29. Elver (young Eel)
 May 6. *Actinosphaerium Eichornii*
 " 13. *Cercaria* (Larva of Fluke)
 " 20. *Spirogyra* in conjugation
 " 27. *Euglena viridis* (red stage)
 June 3. *Fredericella sultana*
 " 10. *Conochilus volvox*
 " 17. *Planaria lactea*
 " 24. *Nitella* (in fructification)
 July 1. Larval Shrimp
 " 8. *Raphidomonas semen*
 " 18. *Noctiluca miliaris*
 " 22. *Leptodora hyalina*
 " 29. *Spongilla fluviatilis*
 Aug. 6. *Ceistes Janus*
 " 12. *Bacillaria paradoxa*
 " 19. *Syncoyne eximia*
 " 24. Medusiform gonozoid
 " 26. *Lophopus crystallinus*
 Sep. 2. *Bugula turbinata*
 " 9. *Triloculina trigonula* (Foraminifera)



J.W.P. del.

PRASIOLA CRISPA.

(A genus of Ulvaceae (Eelgrass-like Algae), separated from *Monostroma*, Skuret, by the arrangement of the quadrigeminate cells of the frond in lines, with wide intercellular walls; from *Ulva* by the existence of only a single layer of cells, and from both by the absence (?) of a reproduction by zoospores; from *Schizogonium* by the frond consisting of expanded plants. The species are included under *Ulva* (the terrestrial forms) in the *Brit. Flora* and *Harvey's Algae*, ed. 1. They have recently been examined by Jenson, who finds the fronds proliferous at the margins; the spores he describes as consisting of motionless cells formed of the entire contents of the cells of the frond, set free by the solution of the parent cell. The reproduction of this group seems to us to require further investigation.

(Micrographic Dictionary).

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STENTOR NICER.

Small, of a dark brownish-yellow or blackish colour; granules olive-coloured; nucleus spherical; lateral crest absent; frontal wreath of cilia continuous. This species is often so abundant that it colours large pools, in turfy hollows, of a dark blackish hue, resembling an infusion of coffee. The swimming movement of this species is readily seen with the naked eye. 1-76.
(Pritchard's Infusoria.)

Thos. Bolton, 57 Newhall St. Birmingham.

simultaneously in most of the filaments of a colony. The cell which lies immediately above the basal cell form a resting spore; it becomes thicker, & at the same time 10 to 14 times as long as thick, of cylindrical form with rounded ends, & now forms, so to speak, the handle of the whip-shaped filaments, its contents become denser, & darker from numerous granules, without, however, losing the bluish-green colour, & it surrounds itself with a compact firm membrane or sheath. At the commencement of the winter the cultivated plants disappear, only the spores together with their sheaths remain behind, & commence germinating in January. The cylindrical cell divides first of all into 4, 6, 8, or 12 shorter cylindrical cells; the bipartition is then repeated in all the cells through several generations, untill the filament which arises in this manner from the spore numbers from 120 to 150 cells. The cells have already begun to be rounded off, & the filament has become moniliform; as it lengthens it splits the envelope of the spore, or raises up its upper part like a cap, while the lower end of the filament remains in the sheath. With its increase in length the filament decreases in breadth. When it has attained double the length of the sheath, it escapes completely from it, & the terminal cells become pointed. The filament then splits up into from 5 to 7 pieces about equal in length & in the number of their cells; the pieces place themselves close to one another, untill they form a bundle or tuft; then each piece begins to transform itself into a whip-shaped Rivularia-filament; one terminal cell becomes the basal cell; at the other end of the filament the cells elongate into an articulated hair. Various deviations from these normal processes occur however not unfrequently. The tuft of threads proceeding from a spore now forms a young mass of Rivularia, the threads of which are already imbedded in jelly. The multiplication of the filaments of a young growing mass takes place by apparent branching, i.e. one of the lower cells becomes a new basal cell; the piece of filament lying between it & the old basal cell develops into an independent filament, which places itself beside the mother filament.

(Julius Sachs' Text-book of Botany.)

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Rivularia angulosa.

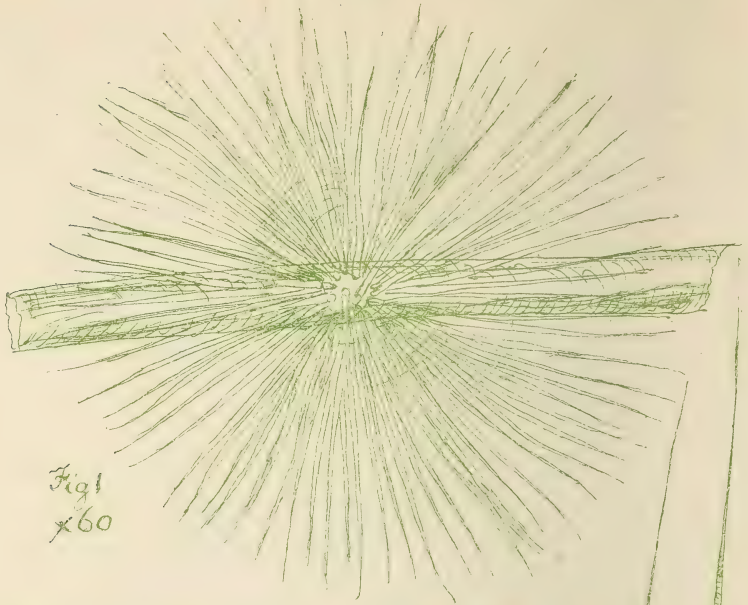


Fig 1
x60

The history of the development of *Rivularia* has been observed by Dr. Barry. *Rivularia angulosa* forms soft greenish-brown gelatinous masses, some of which swim freely in stagnant water, while others are attached; the former are about $\frac{1}{2}$ mm., & spherical, the latter about the size of a nut & hemispherical. In the interior are found numerous threads arranged radially, they are moniliform, & are composed of roundish cells which, however, taper into an articulated beak at the peripheral end of each thread, while at the central end of the thread is a heterocyst or basal cell, so that each thread may be compared somewhat to a riding-whip. The pointed end of the thread does not grow, but the longitudinal growth, & the increase in number of the transverse division continues further downwards as far as the basal cell. The bifurcation takes place nearly

Fig 2
x240

Vaucheria.

Illustrations of the reproduction (after Hassall) Fig 1 to 8. The formation of motile gonidia or zoospores may be readily observed in these plants, the whole process usually occupying but a very short time. The extremity of one of the filaments usually swells up in the form of a club, & the endochrome accumulates in it so as to give it a darker hue than the rest; a separation of this part from the remainder of the filament, by the interposition of a transparent space, is next seen; a new envelope is then formed around the mass thus cut off; and at last the membranous wall of the investing tube gives way & the zoospore escapes, not, however, until it has undergone marked changes of form, and exhibited curious movements. Its motions continue for some time after its escape, and are then plainly seen to be due to the action of the cilia with which its whole surface is clothed. Fig 9 is drawn from some of the *Vaucheria* sent here, with showing an Oospore after impregnation of the spent horn-like Antheridia at its side. A true sexual reproduction. In Portfolio N^o 5 will be found a drawing of germinating gonidia of this Alga.

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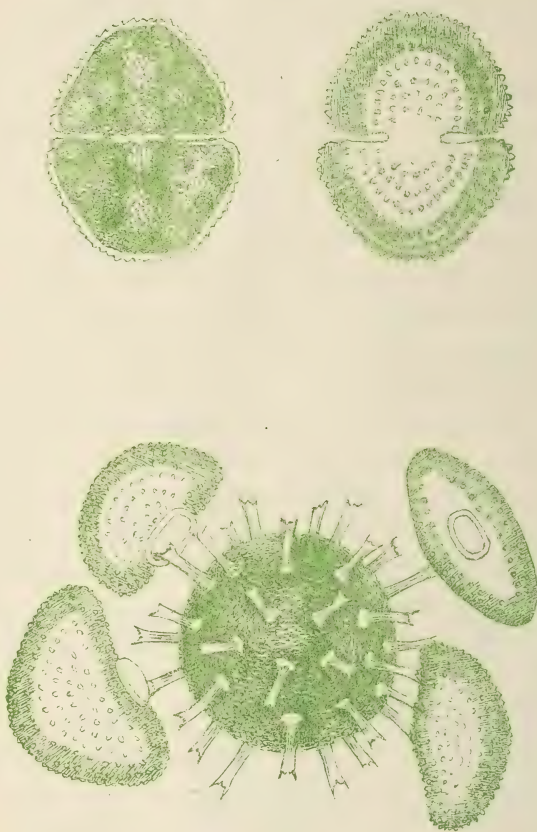
VAUCHERIA.

Ag. del.

Cosmarium botrytis.

The proper Generative process in the Desmidiaceae is always accomplished by the act of conjugation; which commences with the dehiscence of the firm external envelope of each of the conjugating cells, so as to separate it into two valves. The contents of each cell thus set free without any distinct investment, blend with those of the other; & a 'zygospore' is formed by their union, which soon acquires a truly membranous envelope. This envelope is at first very delicate, & is filled with green & granular contents; by degrees the envelope acquires increased thickness, & its contents become brown or red. The surface of the zygospore is sometimes smooth, as in *Closterium* & its allies; but in the *Cosmariceae*, it becomes granular, tuberculated, or even spinous, the spines being sometimes simple & sometimes forked at their extremities. - The subsequent history of the zygospores has hitherto been made out in only a few cases. From the observations of Mr. H. Thomas on *Cosmarium*, it appeared that each zygospore gives origin, not to a single cell but to a brood of cells; & this view is fully confirmed by Hoffmeister, who speaks of it as beyond doubt that the contents of the zygospores are transformed by repeated binary subdivisions into 8 or 16 cells, which assume the original form of the parent before they are set free by the rupture or diffuence of the enclosing wall. The observations of Jenner & Hooke render it probable that the same is the case in *Closterium*; but much has still to be learned in regard to the development of the products of the Generative process, as it is by no means certain that they always resemble the parent forms. For it is affirmed by Mr. Ralfs that there are several Desmidiaceae which never make their appearance in the same pools for two years successively, although their zygospores are abundantly produced a circumstance which would seem to indicate an 'alternation of generations.' it is a subject, therefore, to which the attention of Microscopists cannot be too sedulously directed. (Dr. Carpenter's Microscope.)

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J.W.P. del.

COSMARIUM BOTRYTIS.

Fresh-water Diatoms.

The enclosed tube contains a very rich gathering of Stauroneis Phoenicenteron especially, and of the other Diatoms sketched, as well as many specimens of Synedra radians, Navicula cryptocephala, N. amphirhynchus, Pinnularia mesolepta, and Diatoma elongatum, besides many others. Amongst the Diatoms are many of the pretty transparent Rotifer Hydatina senta (figured in my Portfolio No. 1) busily devouring the Diatoms many of which may be seen in their stomachs. These Diatoms and Rotifers will be very readily examined if a little of the sediment is placed in a hollow slide where they can be examined with a $\frac{1}{4}$ inch objective. I would recommend my correspondents to search the sediment well, as amongst other interesting organisms I have found amongst it pretty abundant some very large and active Amœba, or what I rather suspect to be the new Rhizopod Lithamœba discus, figured and described in the Quarterly Journal of Microscopical Science 1879. Page 424. by Prof. E. Ray Lankester.

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Fig 1.



2.



3.



4.



5.



Fig 1. *Staurooneis Phœnicenteron*.

" 2. *Navicula ovalis*.

" 3. *Synedra pulchella*.

" 4. *Pinnularia viridis*.

" 5. *Nitzschia tenuis*.

after Rev. W. Smith.

J. G. del

Hydrocharis morsus-rance.

The extremities of the roots of this plant (Frog-bit) are well adapted for showing the Rotation, Cyclosis, or so called Circulation of the sap in plants.

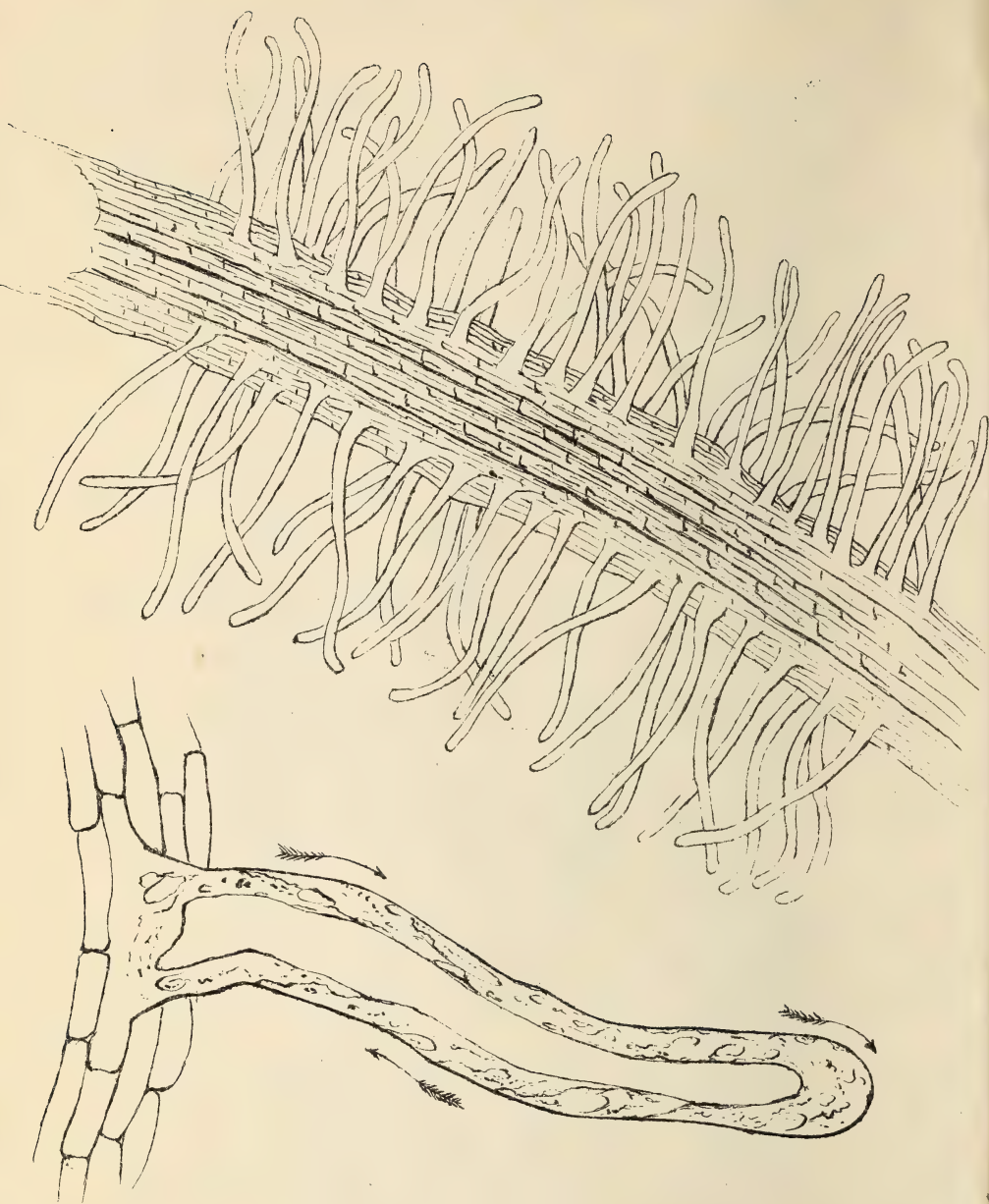
The circulation consists of the flowing movement of a layer of colourless protoplasm over the inner surface of the walls of the cell. The rapidity of the current varies according to the age of the plant, and the activity of its vegetation. It is rapid in hot weather and in sunshine. Artificial elevation of temperature in the water in which the plant grows, up to a certain point, hastens the movement.

The Frog-bit is I think best examined in a large trough with loose plate, and iwedged so that the roots may be pressed against the front glass of the trough.

The Cyclosis may also be seen in the leaves of the common American weed (*Anacharis albinastrium*), another plant belonging to the order of the Hydrocharidaceae.

In this case a very young leaf should be taken from the growing point of a vigorous stem, and when placed on a slide with a drop of water, and covered with a glass slip, should be examined with the highest power available, at least $\frac{1}{4}$ " or $\frac{1}{8}$ ", with a strong light.

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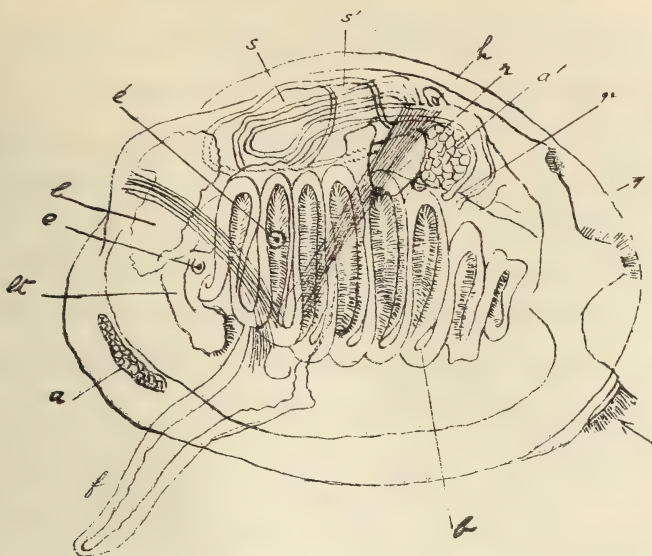


ROOTLETS OF FROGBIT.

SHEWING CYCLOSIS.

JWP del.

Fig. of the Mussel. *Mytilus edulis*.



e, eye; e' auditory capsule; lt, labial tentacles; ss, the s. muscle; b, branchiae; h, heart; v, vent; l, liver; r, renal organ; a, anterior adductor; d, posterior adductor; f, foot. The arrows indicate the incurrent and excurrent openings; between which the margins of the mantle are united in the fig.

The young bivalves are hatched before they leave their parent. At first they have a swimming disk, fringed with long cilia, and armed with a slender tentacular filament (flagellum). At a later period this disk disappears progressively, as the labial palpi are developed; and they acquire a foot, and with it the power of spinning a byssus. They now have a pair of eyes situated near the labial tentacles, which are lost at a further stage, or replaced by numerous rudimentary organs placed more favourably for vision, on the border of the mantle.

(Woodward's Mollusca)

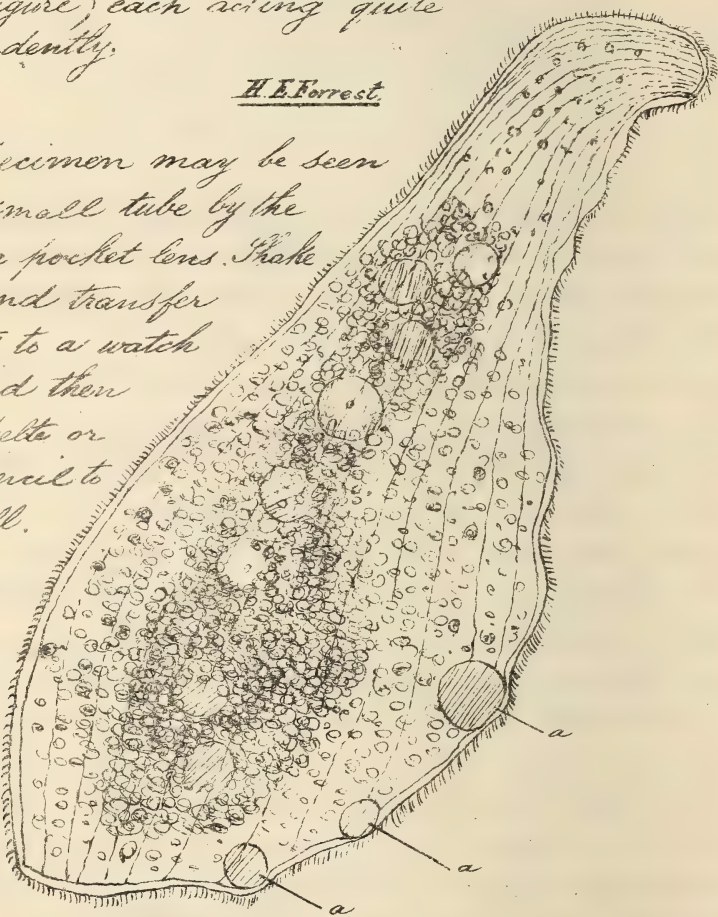
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Loxophyllum meleagrus.

Often met with in stagnant water, crawling about in the weeds. The cilia are extremely minute, so that it never swims freely in the water. The number of contractile vesicles is variable usually there is only one, but sometimes as many as three are present (see a. a. a. in the figure) each acting quite independently.

H. E. Forrest.

The specimen may be seen in a small tube by the aid of a pocket lens. Shake it up and transfer contents to a watch glass and then with pipette or sable pencil to glass cell.



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Condyllostoma patens.

Body highly elastic, elongate-elliptical or ribbon-shaped, more or less undulate, nearly cylindrical, its length when extended equal to 7 or 8 times its greatest breadth, widest posteriorly, somewhat flattened anteriorly, slightly contracted behind the region of the peristome; peristome-field consisting of an irregularly triangular or harp-shaped excavation occupying an almost median position at the anterior extremity of the ventral surface, its length equal to about $\frac{1}{2}$ to $\frac{1}{3}$ of the entire body, succeeded by a narrow tubular pharynx equal to one-half the length of the peristome; undulating membrane conspicuous, extending over the whole length of the right side of the peristome-border, its width equal to one-half of that of the peristome-field; peristome-field unciliated, very transparent, cuticular striae fine, distributed equally and in parallel longitudinal lines throughout the surface of the body; endoplast elongate, moniliiform, located towards the right side; contractile vesicle canal-like, often breaking up into vesicular spaces that extend along the entire left border of the animalcule. Length of extended body $1\frac{1}{2}$ to $\frac{1}{4}$ ". Hab.- Sea water.

(W. Saville Kent's Manual page 584.)

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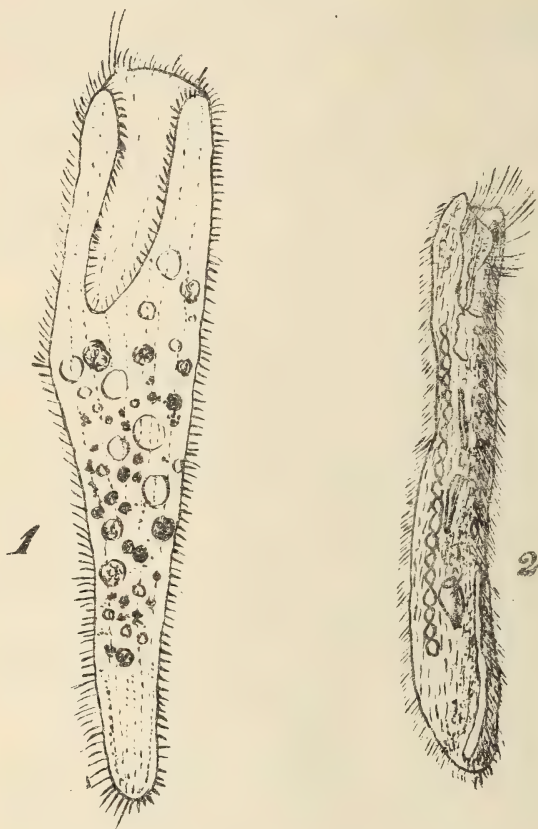


Fig. 1. (from life) × 200.

Fig. 2. (after Stein) × 150.

Condyllostoma patens.

Fig 1.- *Vorticella nebulifera*, expanded, $\times 250$. a contractile vesicle, b disc.

" 2.- ——— " ———, contracted, $\times 250$. a nucleus.

Stalk long, contractile, not branched; usually gregarious.

" 3.- *Carchesium polypinum*, $\times 100$.

" 4.- ——— " ——— " ———, stem of, $\times 250$

" 5.- ——— " ——— " ———, individual, $\times 250$.

Stalk long, contractile, branched, spreading. Bells on one side of branch only.

" 6.- *Epistylis flavicans*, $\times 100$.

" 7.- ——— " ——— " ———, individual, $\times 250$. The arrows indicate the movements of the contents.

Stalk shorter, rigid, not contractile, branching irregularly at the top, so as to form a large head of bells.

" 8 and 9.- *Vorticella*, showing self-division, $\times 200$.

" 10, 11, and 12.- *Vorticella*, showing encystation, $\times 350$.

" 15.- *Carchesium*, showing gemination, $\times 200$.

" 14.- *Vorticella*, free embryo, $\times 300$.

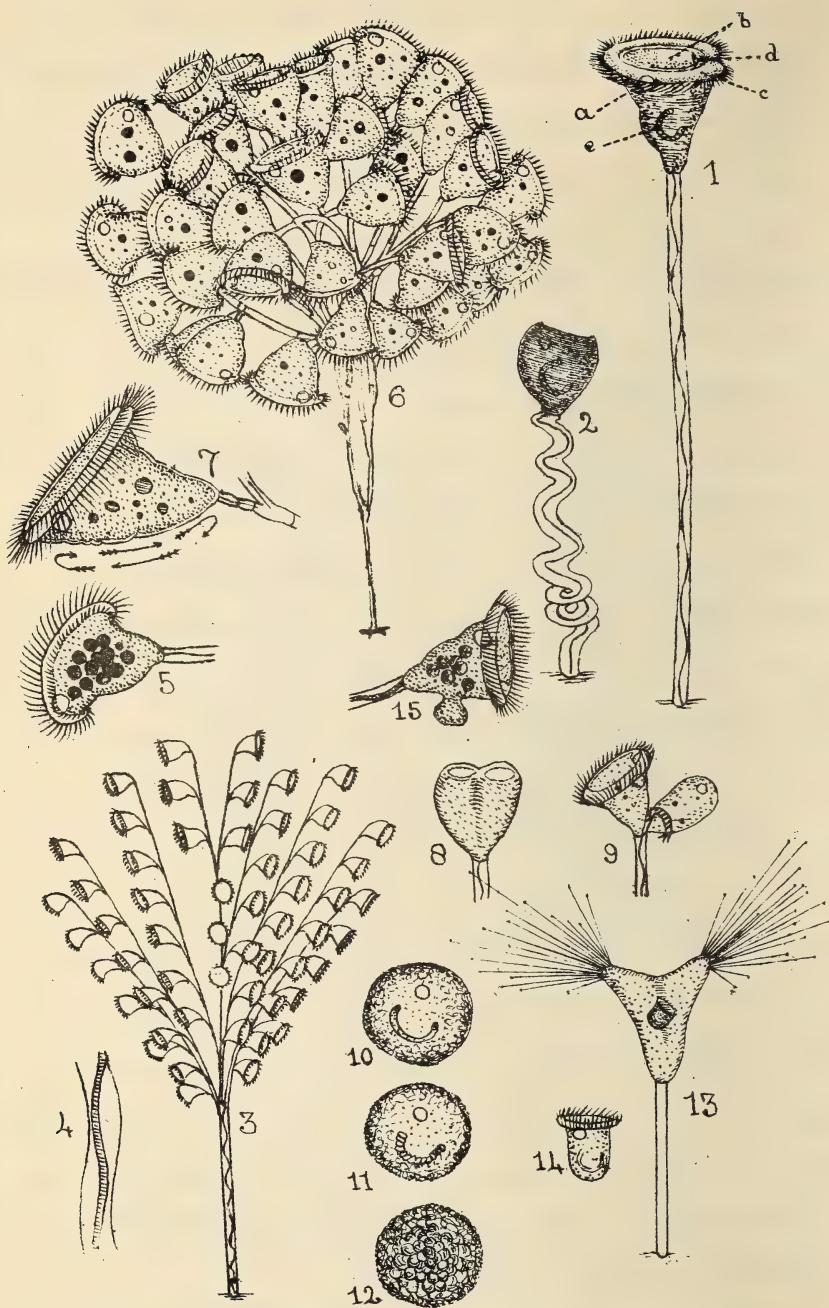
" 13.- *Acineta lemnarum*.

(H. E. Forrest's paper in *Vorticella* in *Midland Naturalist*, May 1877.)

Acineta lemnarum, grouped by W. Gaville Hunt in the order of the *Sentaculifera-suctoria*. It was originally described by Stein as the immature or "Acinete" condition only of some higher Peritrichous ciliate Infusorium, the habitat of this particular type inducing him to regard it as a transitional form of *Vorticella nebulifera*.

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Plate I.



H. E. Förrest, del.

On the development of the Vorticellidæ.

Loothamnium arbuscula.

Loothamnium arbuscula is an exquisitely beautiful Animal. It is as rare as it is beautiful, and consequently very little has been written about it. The only complete account extant is by Ehrenberg, in his magnificent work on the Infusoria (page 204). He states correctly that there are two kinds of bells—large and small; that the colony is umbellate, and that the stem and branches contain a muscular cord. But he also gives many particulars which I cannot confirm, e.g., that the colony is not always umbellate; that the large size of the knobs (Fig. 10) is caused by these individuals remaining longer attached than the others without subdividing; yet he says further that these same knobs divide while still attached. He also mentions the sperm-gland, (i.e., nucleus) but does not figure it, and states that he has "succeeded in observing the taking of indigo into twenty-two stomachs!" His figure, although splendidly drawn, is not a bit like the object it is supposed to represent. I have attempted to portray *Loothamnium* at Fig. 11, but the best drawing possible would be but a caricature of it; the fairy-like grace of its form, and the pure translucency of its whole substance, cannot be reproduced on paper; they must be seen to be appreciated. The word *Loothamnium* is derived from the Greek *Loon*, an animal, and *Thamnos*, a tree. *Arbuscula* is Latin, and signifies a little tree. The names are particularly well chosen, for to the naked eye *Loothamnium* presents the appearance of a beautiful pearl-white polyp or tree-fern (Fig. 9), about $\frac{1}{6}$ or $\frac{1}{4}$ of an inch high, waving gracefully to and fro in the water, and ever and anon contracting (Fig. 10) to $\frac{1}{4}$ the size, soon to re-expand in all its original beauty. When submitted to the microscope (Fig. 11) the resemblance to a tree becomes still more striking. We see a long trunk or stem, branching out at the top horizontally; each branch is divided into a number of twigs, thickly studded with minute bells, analogous to leaves. Here and there (Fig. 11b.) we have large round globes attached to the branches; these represent the fruit; and to complete the picture there are frequently two or three sprightly Rotifers flitting from branch to branch like birds.

Description of Figures.

- 1.—Muscle from main stem.
 - 2.—Portion of branch.
 - 3.—Single bell. a, contractile vesicle.
 - 4, 5, 6.—Stages in the development of a reproductive cell while still attached to the branch.
 - 7, 8.—Ditto, after detachment.
 - 9.—Colony of *Loothamnium*. 10.—Ditto, contracted.
 - 11.—Ditto. b, b are the reproductive cells.
- (H. G. Forrest, in *Midland Naturalist*, May 1879.)

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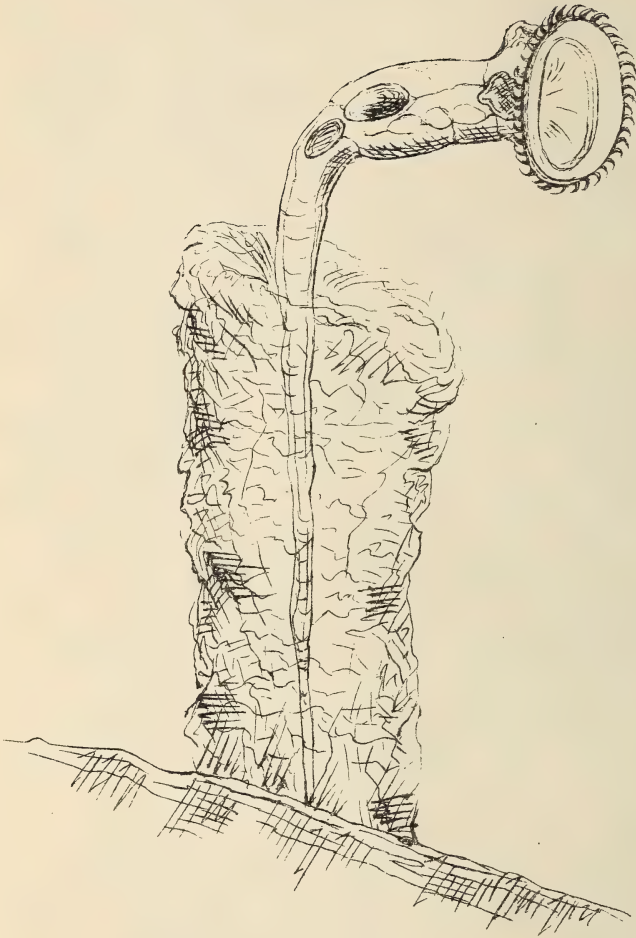
Loothamnium arbuscula.

Acistes crystallinus.

Genus *Acistes*.—Characterized by each animalcule having a separate lorica. The two eyes, situated anteriorly, become effaced as age advances. Ciliary wreath simple and frontal, the long tail-like foot has internal longitudinal muscles. Alimentary canal simple, tubular, contractile, stomach elongated; teeth attached in rows to two jaws situated in the pharyngeal bulb, and two glands, compose the apparatus of nutrition. The visual organs are red when the animalcule is young, & colourless in old age. The ovarium has only a single ovum. The envelope is a viscid, gelatinous, cylindrical sheath (urceolus), into which the animalcule can entirely withdraw itself, or which it may quit when a new one is desirable. The attachment to the bottom of the lorica is by the under surface of the end of the foot-like tail.

Acistes crystallinus.—Lorica hyaline, viscid, floccose; body crystalline. The structure it is difficult to see. Each jaw has 3 distinct teeth. The development of the young from the egg is interesting to observe.

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x300

J.W.P. del.

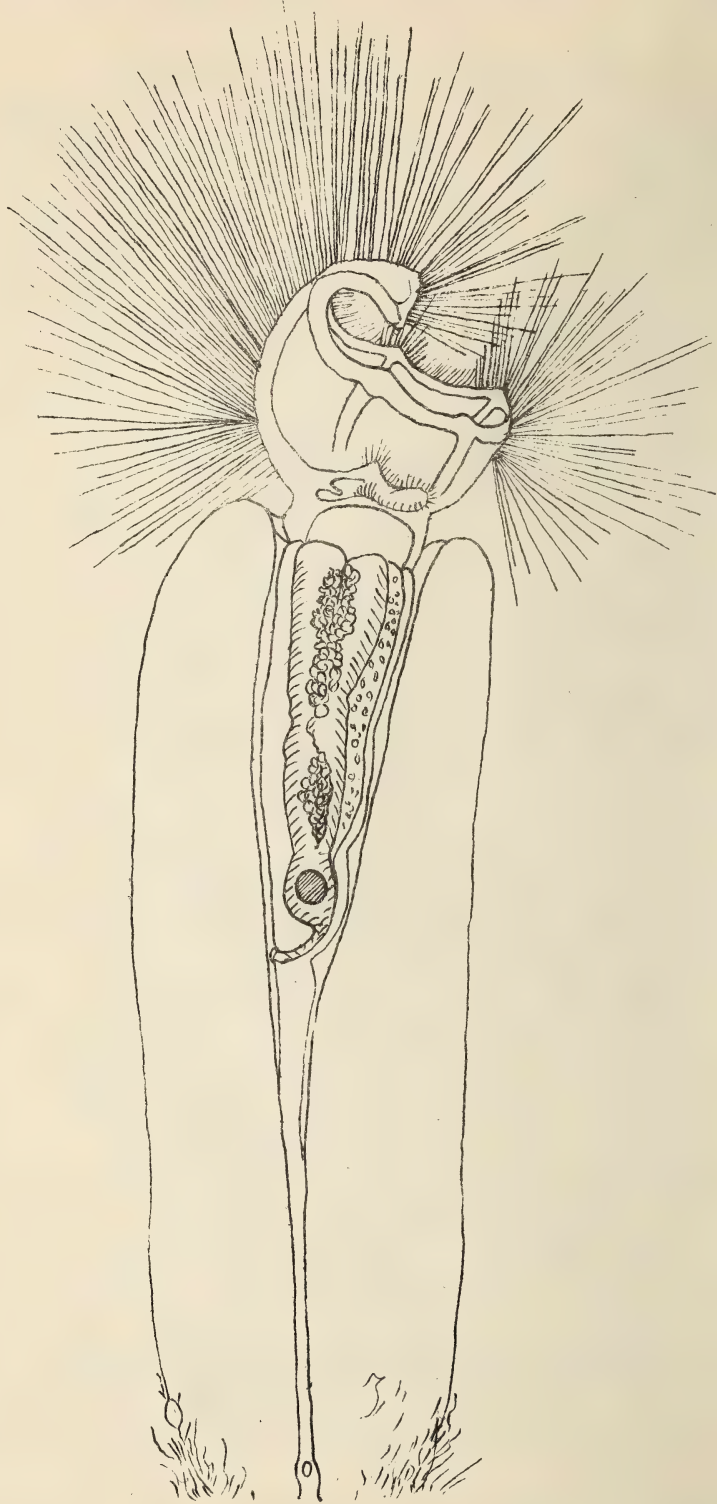
OECISTES CRYSTALLINUS.

Muscularia campanulata.

This differs from *Hornata* and *H. cornuta* in the great breadth of the disk, as compared with the body. It forms a wide, shallow funnel, the edge of which projects into 5 very obtuse points, without knobs, the dorsal one broader and higher than the rest, and frequently arched inwards. All the points are beset with the usual radiating bristles. The dorsal projection I have occasionally noticed to present an appearance of perforation, but it may have been illusive. A clear, round, well-defined space will sometimes form in the midst of this area, of which not a trace can be discerned before or after. All round the edge of the disk there passes a narrow band of granular tissue, which seems to be a continuation of the sensitive contractile membrane which lines the upper part of the body, and forms the crop; for it may be traced along each side of the neck (in this species a distinct broad collar), to the margin of the crop. It has thickenings at the angles of the disk, & at the constriction of the collar. The ciliary vortex, as in *H. ornata*, brings in animalcules to the funnel-disk. If they are not carried far in, the margin makes a slight and momentary contraction, by which the prey is forced downward; but more commonly the sensitive tissue that encircles the first neck contracts upon the prey, & keeps it from escaping, until the centre of the diaphragm can grasp it, which is but the work of a moment, when it passes into the crop with a quick, swallowing motion."

(P. H. Gosse F.R.S. Popular Science Review Vol. 1 page 167.)

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Floscularia campanulata.

Floscularia trifolium.

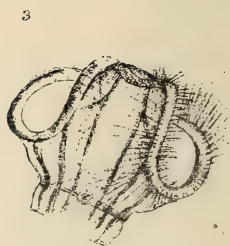
Fig. 1. - Three females, from different points of view. Fig. 2. - Side view of the body. Fig. 3. - Back view of trochal disk; showing the 2 rows of setae down one side of a lobe. In all the figures: - a, horseshoe row of small cilia; b, longitudinal muscles; c, antenna; d, crop; e, tube from mouth into crop; f, mastax; g, ovary; h, stomach; k, its lower division; l, vent; m, transverse muscles; n, gastric gland; o, ganglion; p, thickening of trochal disk; r, curved bristles; s, knob-covering gland; t, ciliated chin.

Neither pen nor pencil can do justice to the exquisite grace of this beautiful creature. From every point of view the flowing curves of the trochal disk are charming, and its great transparency permits of the whole outline of the rim being seen at once. One of the lobes (that usually termed the dorsal one), is rather larger than the others, and it is slightly curved over the mouth; across each lobe run delicate muscular threads for furling it. The expansion of the lobes is doubtless produced by the transverse muscles of the body, which, by compressing it, force fluid upwards between the two membranes of which the lobes are composed. This can be readily seen in *F. campanulata*, in which the fluid carries along with it numbers of granules, whose rush upwards to the lobes, as the *Floscule* expands, is easily visible under dark field illumination. It was for a long time a moot point how the vortex was caused which, settling down between the lobes, draw its prey to the *Floscule's* mouth; and at last it was made out that a horseshoe-shaped row of very fine cilia (figs. 1 and 2, a) lay at the bottom of the lobes where they join the neck. If *F. trifolium* had been a common rotifer, there would have been no difficulty about the matter, for this row of small cilia can be easily seen in almost any position, owing to the animal's great size and transparency. It is unnecessary to describe in detail its other organs, as so far as I have observed they are in no respect different from those of the other *Floscules*."

(D^r Hudson in Journal of the Royal Microscopical Society)

Jan. 4, 1881.

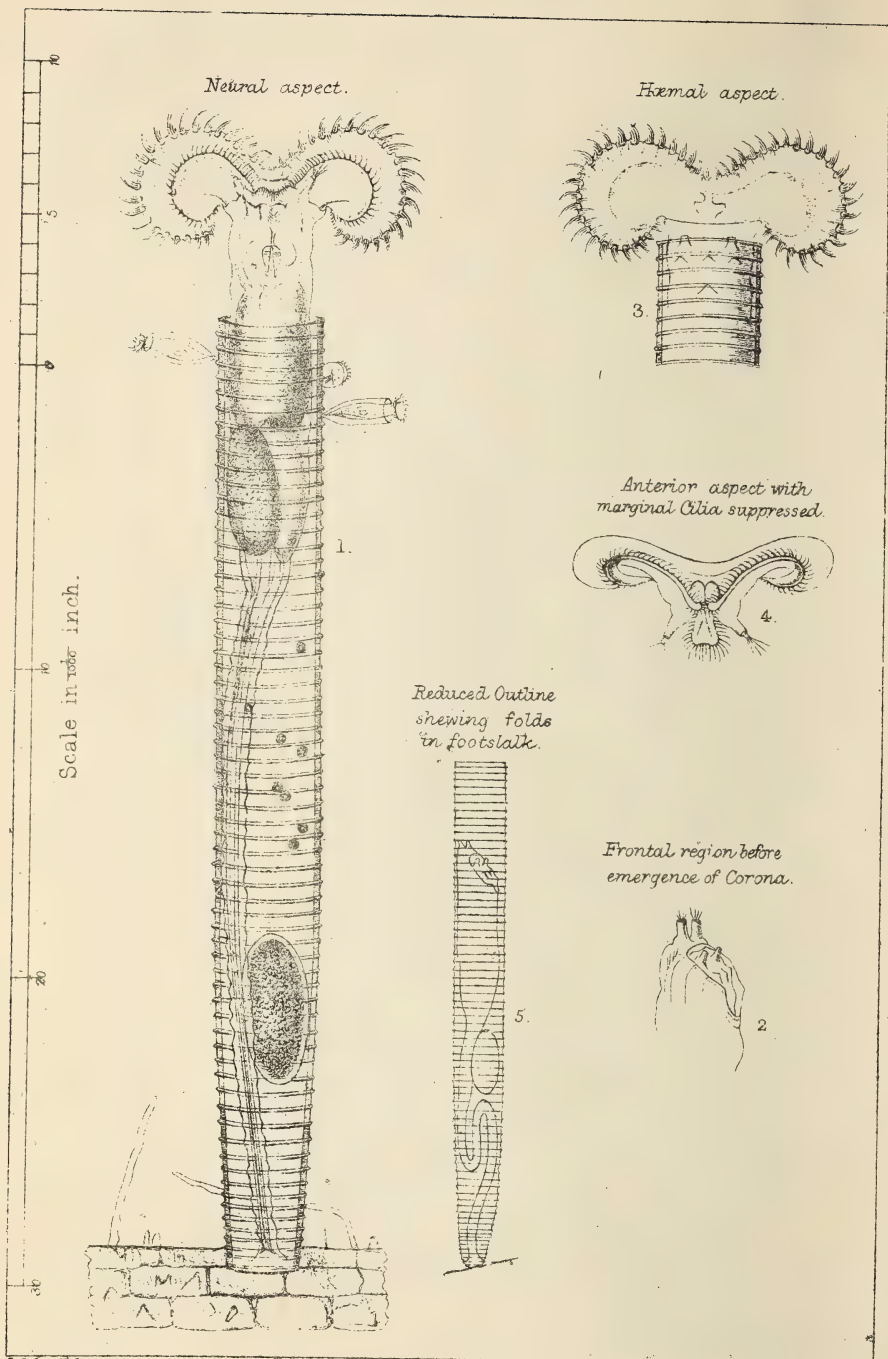
It was Bolton, 54 Newhall St. Birmingham.



Floscularia trifolium.

Limnias annulatus.

My attention was first drawn to a vagina of this species, which at a glance exhibited proportions differing from any hitherto known form, containing within it an ovum of a magnitude equally surprising. I at once applied the micrometer, and for the moment failed to notice the corrugations which, singularly enough, coincide exactly with the 2000th divisions of the micrometer; they occur as little ridges formed around the circumference of the vagina, which in all young, and young adults is perfectly hyaline, manifesting a decided and brilliant orange tint, but seen at the two sides when in proper focus they are rendered very distinct, the orange tint becomes condensed into a deep carmine. How these ridges become formed with such marvellous precision is a matter that must strike all with wonder and admiration; and although I do not feel myself prepared at once to state anything definite as to their formation, I can only suggest it as worthy of attention that the anterior regions manifest a considerable and somewhat complicated departure from those of the other *Melicertians*. In its retracted condition fig 2, the corona manifests 2 distinct projecting processes beyond the setiferous tubes which, though they present the same general appearance, are not provided with setae, but manifest at their extremities a bright red spot under the illumination of the Henham parabola; we do not expect to find eyes in a haemal aspect as these spots are situated; beneath them there are 3 other processes which are less highly developed, & the distance between these 2 upper processes & the 3 lower ones corresponds precisely with the "pitch," or distance apart of the annulets of the vagina; & we see that ~~although~~ the corona is frequently protruded far above the margin of the vagina." (*The Monthly Microscopical Journal*, Oct. 1871.)
by Charles Eastw.
Thos. Bolton, 54 Newhall St. Birmingham.



C. O'Brien del.

W. West & Co. imp.

Limnias annulatus

Piscicola geometra.

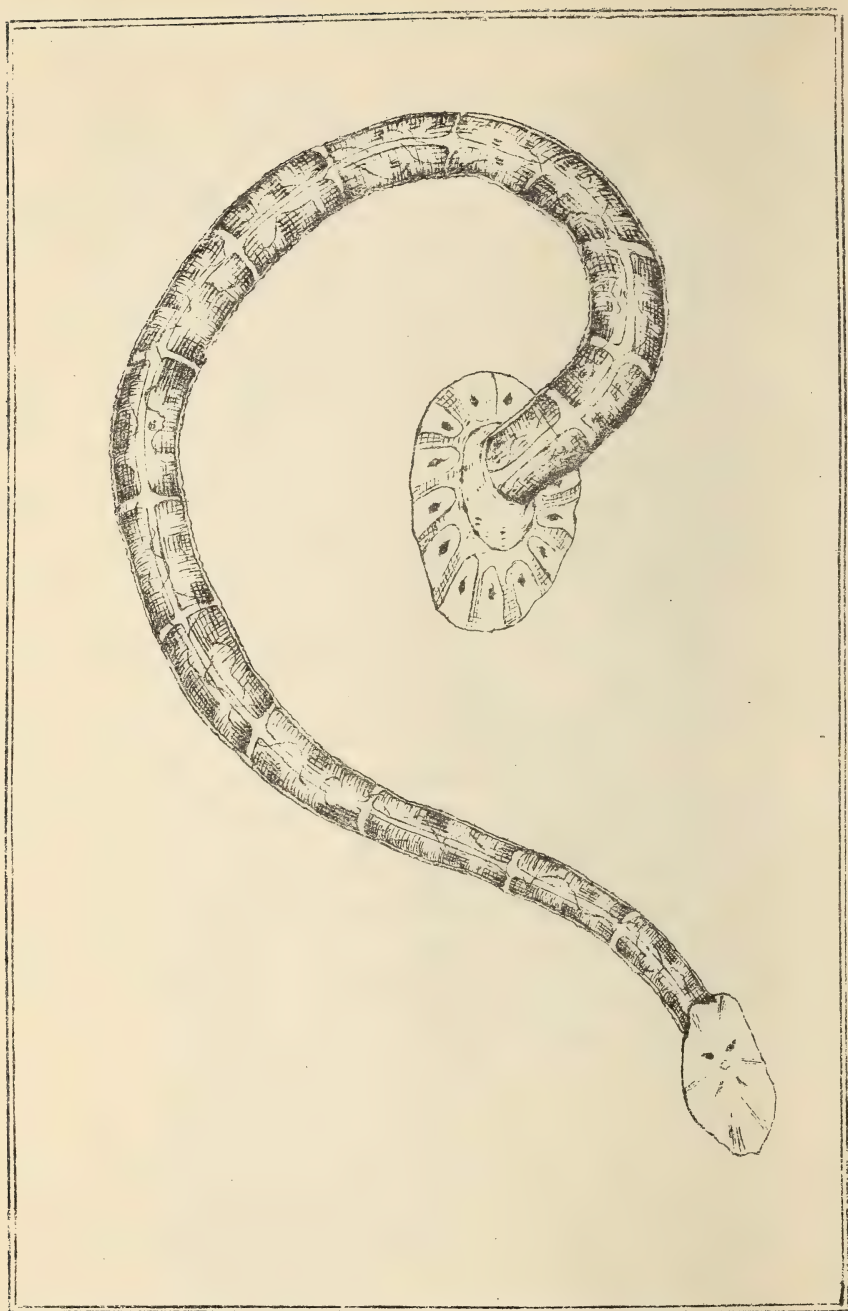
The great tailed leech.

Char. Body elongate, subcylindrical, a little narrowed forward, indistinctly annulated: oral sucker saucer-like, eccentrically attached, structured at its insertion; mouth small, inferior edentulous; eyes in pairs on the dorsal side of the sucker: anal sucker larger than the oral, eccentrically attached, somewhat elliptical, with a simple thin margin: male orifice at the base of the neck, the female posterior to it: vent very small, and scarcely visible. Lacustrine. *P. geometra*, eyes eight, in pairs congregate on a fuscous spot; anal sucker rayed with fuscous, and marked between the rays with eight blackish dots. Length $2\frac{1}{2}$ "; breadth $\frac{1}{2}$ ". Hab. In lakes, infesting the fish.

D^r. Johnston's British Non Parasitical Worms.

There is a well illustrated paper on the allied species of Snail Leeches in the Intellectual Observer 1865 by the Rev. W. Houghton, and another in 1868 by the same Author in our Fresh-water Planariae. This writer recommends the late Monguin Sandous Monographie de la Famille des Hirudinees. Paris, 1846.

Thomas Bolton, 54 Newhall St. Birmingham.



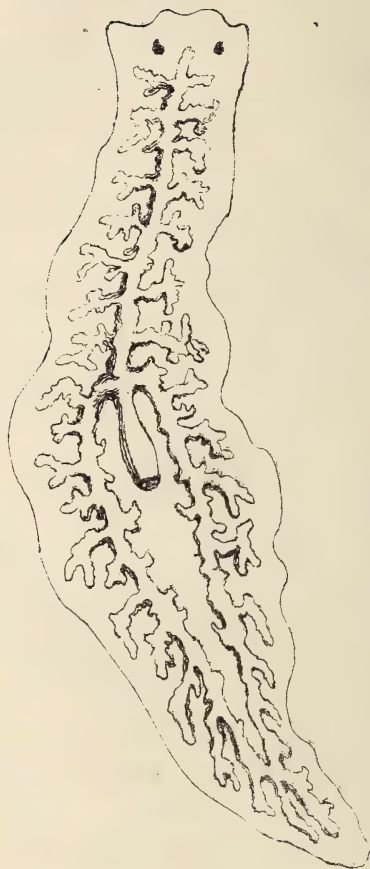
PISCICOLA GEOMETRICA.

“ Planaria lactea.

This species varies a little in colour, which is either cream, roseate, or quite white; it is from six to ten lines in length, and about two lines in breadth; we first notice the delicate arborescent form of the digestive system; we place the creature on a glass slide & hold it up to the light, in its middle part we see a milk white spot which extends linearly towards the posterior extremity; by allowing the water gradually to evaporate, the animal shows signs of discomfort, and we observe a long cylindrical tube to be pushed out from a pore slightly posterior to the middle of the body: this pore is the mouth, and the tube is the proboscis, a formidable instrument of attack in these creatures; we notice two black oculiform spots, parallel, and placed on the anterior part of the back; a little below the oral aperture we see, but very indistinctly in *P. lactea*, another pore which belongs to the generative system; we find the body to be slimy, very soft, and readily breaking up if not handled with great care. Let us take another specimen of the same species, and with the aid of a camel's hair pencil, place it gently in a vessel of water, and observe its locomotive powers; we see it gliding in an even and regular manner, like a *Limax*, or slug; if we touch it, the animal twists itself in various folds, or it fixes its head portion to the vessel, and, by contracting, brings the other parts of the body along, then the posterior part is attached, and the head portion elongates and advances.”

(Our fresh-water Planariae by W. Houghton in)
the Intellectual Observer, January, 1868.

Thos. Bolton, 57, Newhall St., Birmingham, June 17th 1881.

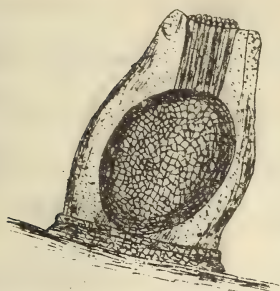


PLANARIA LACTEA.

J. W. del.

PLUMATELLA REPENS

Emerging from the stato-blast



Retracted.



Stato-blast.

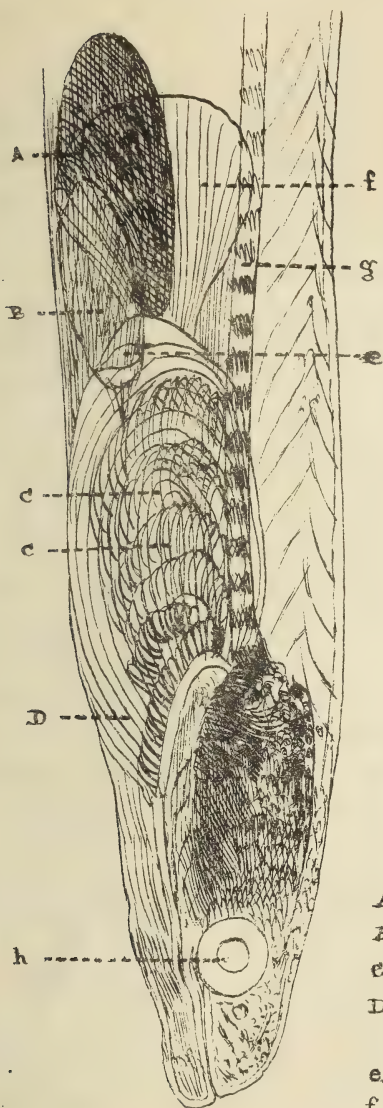


Expanded.

The young *Plumatella* repens just emerging from the statoblasts or winter eggs are lovely microscopic objects. One side of the statoblast is fixed to the stem of a water plant, but the other lifts up like the cover of a vegetable dish, and is carried upwards by the animal when it first hatches. It is not however cast away altogether but remains attached to its side for a considerable time as in the lower figure. The horse shoe shape of the lorophore is apparent even at this stage but is not of course so well marked as in the adult. The young *Plumatella* are capable of regular egestion and retraction, as the parent animals, and the process of feeding, and the action of the stomach in the work of digestion is plainly seen, so far as the protrusion of the body out of the case will allow.

Thos. Bolton, 17 Ann St. Birmingham.
March 13th 1849.

ELVER or YOUNG EEL.



References.

- A. *Arriole of heart*
- B *Ventricle " "*
- c. *Branchial arches*
- D. *Operculum, or Gill-cover.*
- e. *Exhalant orifice.*
- f *Fin.*
- g. *Vertebral column.*
- h. *Eye.*

H.E. Forrest. del.

I enclose a specimen of Elver or young eel,
I give below extract from a paragraph in Science
Gossip Vol. XI page 45 (Feb/45), in which will be
found an interesting quotation in reference to this
fish from Mr Buckland.

It will be most conveniently examined in a
"Zoophyte trough, with an adjustable central plate
or one of about 1/8 in. in depth or thickness. The movements
of the fish should also be restrained by pushing in some
cotton wool round it. It should not be kept under
observation long before it is placed in some fresh water
and be careful to keep it cool.

"In describing the points of resemblance between
elvers and full-grown eels, Mr. Buckland showed the
similarity of construction apparent in their heads
"the lower jaw fitted in above the upper, so as to make
a sort of close-fitting little box, and the eye was exactly
over the level of the junction of the upper and the
lower jaws, the teeth were set in a very peculiar way
upon the roof of the upper jaw"; in their fins, —
"the fin began in about the centre of the body,
and then expanded itself into a beautiful fringe
till it arrived at the tail, where it further expanded
into a flat and very delicate substance"; in their
gills, — "covered up by a most delicate curtain
which acted as a valve, and as a reservoir for
water; thus enabling the fish . . . to keep his gills
moist during the time he is out of water";
lastly in their caudal hearts, for a heart existed
in no other fish except the tadpole!"

This was taken from a report in the Standard
of May 25th or 26th 1844 of a prosecution by the
Severn Fishery Board, when Mr Buckland,
the Magistrate decided "Conclusively established
the fact that elvers are the fry of eels

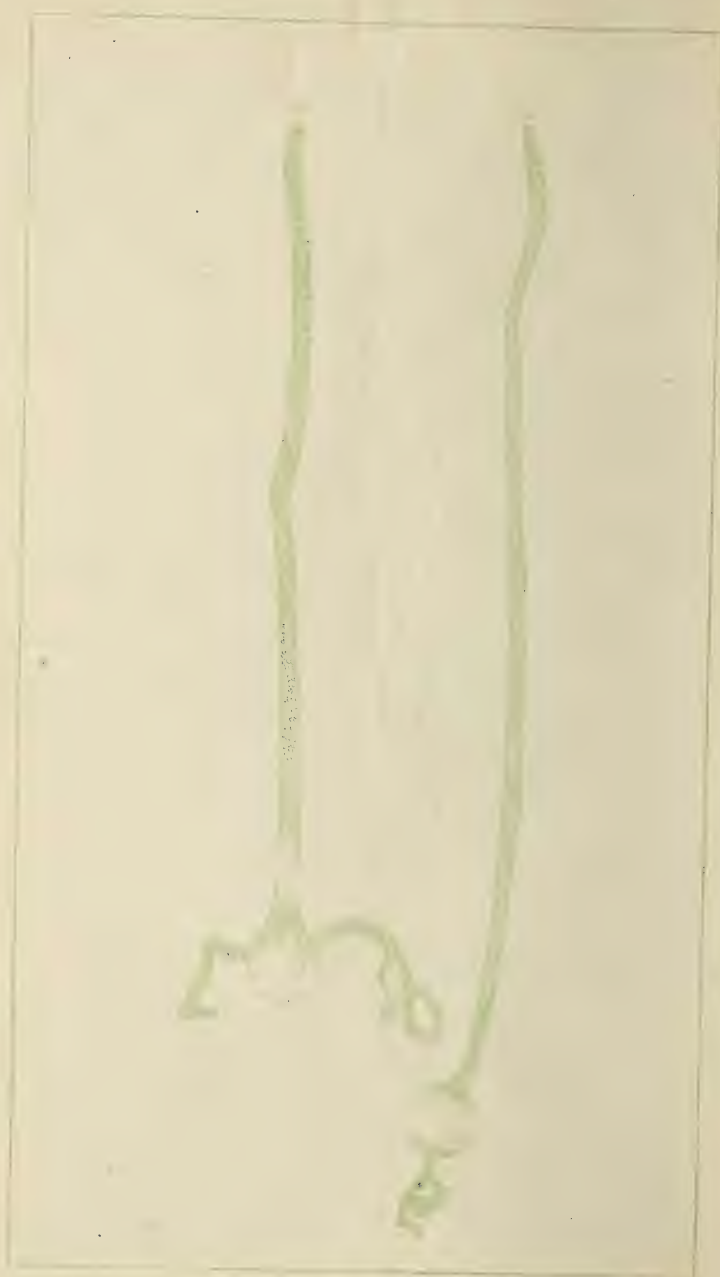
Thos Bolton 14 Ann St. Birmingham
May 2nd 1849.

Finding some curious tufts of brilliant green Algae growing on the glass of one of my fresh-water aquaria just above the surface of the water, I have asked W. Forrest to sketch it, and I will send specimens of it to my correspondents.

It is probably a young form of one of the Enteromorpha. A genus of Ulvaceae (Conferoid Algae), consisting of aquatic and marine plants, with branched tubular green fronds, the walls of the tubes being composed of a single flat layer of polygonal cells.

I am not very conversant with these organisms and shall be glad if any of my correspondents can confirm this, and identify the species, or if I am mistaken, say what it is.

Thos Bolton. 17 Ann St. Birmingham Aug 22/79





H. E. Forrest. del.

Kondylostoma patens
Burmannia ————— ?

Into a small marine aquarium 8 inches by 3 inches deep with sand bottom, in which I have had an oyster and some annelids alive for nearly a year. I lately put a mussel which died. I now find the water abounding with Infusoria, one species of which I have selected for distribution to my subscribers, and Mr. Forrest has sketched it for me. We both took it to be one of the Bursaria but Mr. W. Saville Kent, to whom I submitted some specimens, has identified it as Kondylostoma patens of Dujardin, another genus of the family of the Thachelina.

Pritchard's description is as follows.

Body more or less elongated, cylindrical or fusiform, rather crescentic, with obtuse and flattened ends; mouth very large, bordered by very strong cilia, and placed on one side near the anterior extremity; surface obliquely striated and ciliated. It swallows its food, consisting of other animalcules or of vegetable debris, rather after the manner of Planaria than of Paramecia; for it does not draw it in by the action of the cilia in producing a vortex. It lives only in smooth and pure sea-water among Algae, &c.

Professor E. Ray Lankester has identified the Entomostrecon I distributed last week (provisionally named by Mr. Forrest Daphnia Bairdii) as Hyalodaphnia Kahlbergensis of Schödler. This as well as the Entomostrecon distributed the previous week were both found in the same habitat and are both new to Great Britain. Both Prof. Lankester and his John Lubbock have identified the latter as the Leptodora hyalina of Lilljeborg.

The water I send contains besides the Kondylostoma several other species of Marine Infusoria and other minute organisms about which much is to be learnt.

Thos. Bolton, 17 Ann Street, Birmingham Aug 15 1879

x

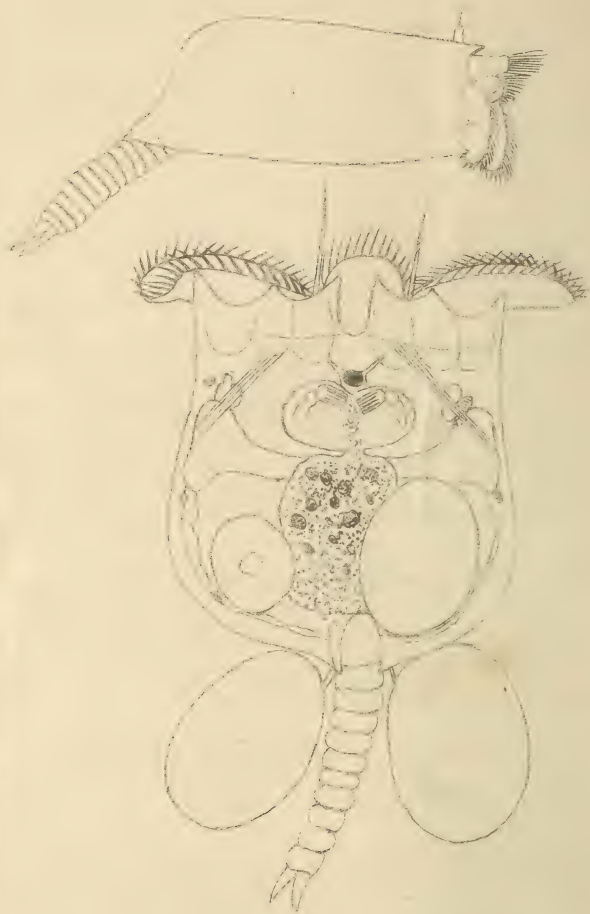
Brachionus urceolaris.

Enclose a good gathering of this active Pitcher Rotifer figured on the other side. -

Description from Richards Infusoria
"Whitish; Lorica smooth, with six very short spines in front; posterior extremity rounded; lorica slightly granulated; its points are shorter and less sharp than other species; delicate longitudinal ridges proceed from the spines; the jaws have each five teeth."

Notice any variations in the size of the eggs, some of the smallest eggs are very likely to be those of males. -

Thom. as Bolton 17 Ann St. Bham. April 30/80.

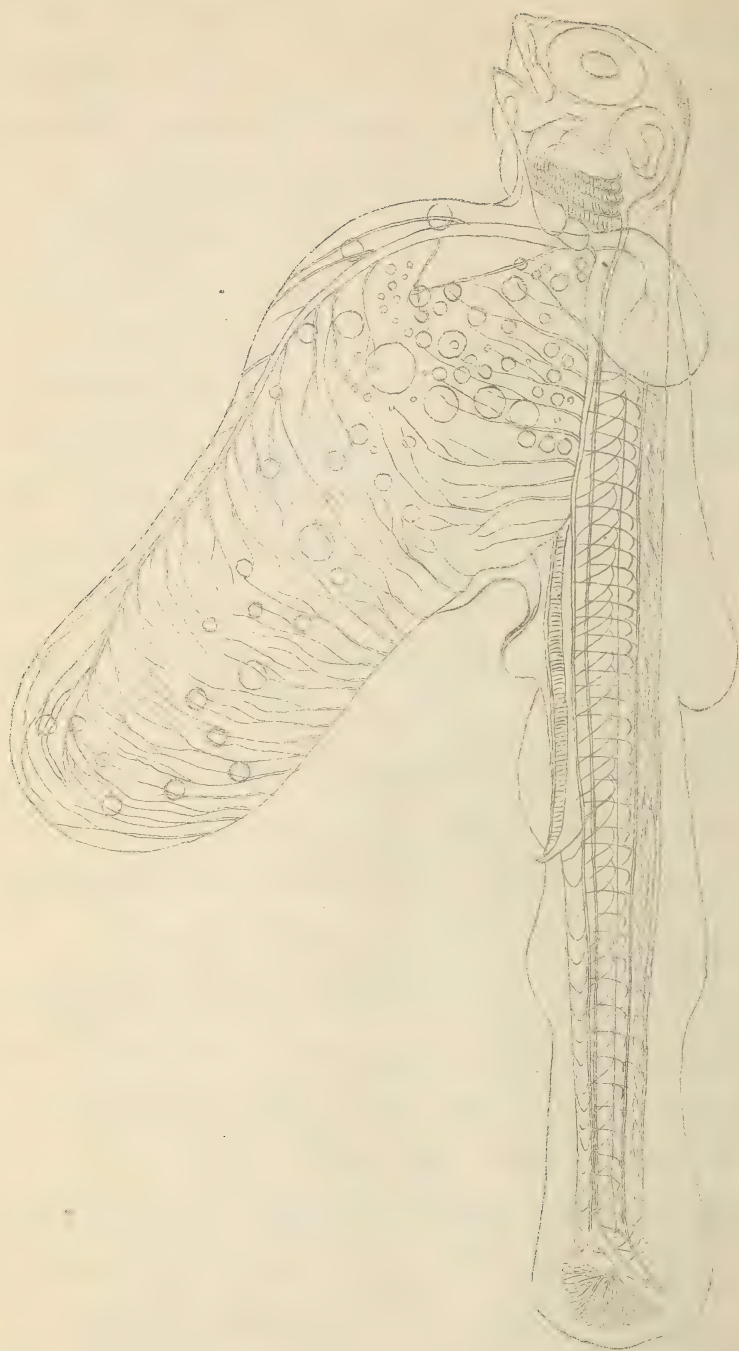


Brachionus urceolaris

H E Forrest, del.

I send you a specimen of young Char in the "Alevin" stage or "Fry" which has just been hatched from the spawn. You will find it a very interesting object for the microscope, requiring only a low power (2 to 3 inch) to shew it to perfection. The eyes are very conspicuous as is also the yolk sac. The latter is covered with numerous fine capillaries, which ramify in all directions over the brilliant orange coloured oil or fat globules, and which globules form the bulk of the yolk. The blood from all these capillaries is poured into one large vein, and enters the heart from whence it is driven forward, part into a large artery just beneath the head, whence it is distributed again into the capillaries, on the opposite side of the yolk, and part into the gills passing through them into an artery which supplies the body with blood necessary to build up its structure. This goes right to the tail of the animal and returns along a vein to the heart, where it mixes with the blood from the yolk sac.

The sketch on the other side is copied from a plate, in the Quarterly Journal of Microscopical Science, illustrating a paper by D. McIntosh on Young Salmon from which Char differ very little at this age. Tho. Bolton, 71 Ann Street, Birmingham, Feb 3, 1880



Colpidium cucullus (of Stein)
x700



This active ciliated Infusorian has appeared in great abundance in a bottle in my studio, which has had in it a very thick gathering of *Oscillatoria*, that is now in a state of disintegration. I was in doubt what they were, having at one time taken them to be a species of *Paramecium*, so I sent some up to Mr. W. Saville Kent, who has kindly identified them for me. I presume this is the same Infusorian, as is figured & described by Pritchard as *Kolpoda cucullus*.—Turgid, slightly compressed; kidney-shaped. The concavity in which the oral aperture is situated is occupied by a process called by Ehrenberg, a "tongue," but which Stein has shewn to be a bundle of longer cilia. The cilia are not distributed over the whole surface, but limited to the convex surface of the anterior half, augmenting in size as they approach its elongated and expanded, wide lip-like or frontal process above

the oral fossa, and to a ridge extending downwards and backwards from the fossa. The granules in the interior are frequently so numerous as to render it opaque; they also give it a grey colour. The single contractile vesicle is seated close to the posterior extremity; the nucleus is a circular disk containing a nucleolus, and nearly central in position.

Thos. Bolton, 17 Ann St. Birmingham Oct 15 1880.

CONTENTS OF PREVIOUS PORTFOLIOS.

CONTENTS: AUGUST, 1879. No. 1.

- | | | |
|----------------------------|-------------------------|---------------------------------|
| VEGETABLE KINGDOM. | | |
| - Nostoc commune. | - Volvox globator. | - Pandorina morum. |
| ANIMAL KINGDOM. | | |
| - Uroglena volvox. | - Rotifers (7 figures). | - Brachionus pala. |
| - Infusoria (9 figures). | - Synchaeta mordax. | - Paludicella Ehrenbergi. |
| - Raphidiophrys pallida. | - Hydatina senta. | - Embryo of Mussel. |
| - Stephanoceros Eichornii. | - Rhinops vitrea. | - Larva of Corethra plumicornis |
| - Limnias ceratophylli. | - Philodina roseola. | - Spawn of Perch. |

CONTENTS: FEBRUARY, 1880. No. 2.

- | | | |
|-----------------------------|------------------------------|--------------------------------------|
| VEGETABLE KINGDOM. | | |
| - Hydrodictyon utriculatum. | | |
| ANIMAL KINGDOM | | |
| - Spongilla fluviatilis. | - Leptodora hyalina. | - Carcinus Mænas, in the Zoea stage. |
| - Peridinium tabulatum. | - Hyalodaphnia Kahlbergensis | - Lophopus crystallinus. |
| - Ophrydium versatile. | - (Daphnia Bairdii). | - Spirobis nautiloides. |
| - Stentor Barretti. | - Sida crystallina. | - Circulation in Egg of Trout. |
| - Carchesium spectabile. | - Diaptomus Castor. | - Young Salmon. |
| - Hydra vulgaris. | - Cristatella mucedo. | |

CONTENTS: AUGUST, 1880. No. 3.

- | | | |
|------------------------------|-------------------------|---------------------------|
| VEGETABLE KINGDOM. | | |
| - Draparnaldia glomerata. | - Chaetophora elegans. | - Chara and Nitella. |
| ANIMAL KINGDOM. | | |
| - Actinosphaerium Eichornii. | - Anurea longispina and | - Bowerbankia gracillima. |
| - Collops hirtus. | - Ceratium longicorne. | - Bosmina longirostris. |
| - Urostylea grandis. | - Melicerta ringens. | - Larval Shrimp. |
| - Dinobryum sertularia. | - Lacinularia socialis. | - Nais proboscidea. |
| - Vorticella chlorostigma. | - Alecyonella fungosa. | |

CONTENTS: FEBRUARY, 1881. No. 4.

- | | | |
|-------------------------|---------------------------|------------------------|
| VEGETABLE KINGDOM | | |
| - Desmids and Diatoms. | - Æcidium urticae. | - Zygnema cruciata. |
| ANIMAL KINGDOM | | |
| - Acineta. | - Marine Infusoria. | - Euchlanis dilatata. |
| - Dendrosoma radians. | - Nassula ornata. | - Asellus vulgaris. |
| - Choano-flagellata. | - Spirostomum teres. | - Ilyocypris sordidus. |
| - Bursaria truncatella. | - Cordylophora lacustris. | - Argulus foliaceus. |
| | - Lucernaria auricula. | |

CONTENTS: JUNE, 1881. No. 5.

- | | | |
|--------------------------|-------------------------|---------------------------|
| VEGETABLE KINGDOM. | | |
| - Protococcus pluvialis. | - Vaucheria. | - Freshwater algae. |
| ANIMAL KINGDOM. | | |
| - Ophrydium longipes. | - Syncoryne frutescens. | - Alecyonidium polyoum. |
| - Stentor polymorphus. | - Anguillula glutinis. | - Bowerbankia imbricata. |
| - Trichodina pediculus. | - Pterodina clypeata. | - Triticella pedicellata. |
| - Clava squamata. | - Gammarus pulex. | - Pedicellina cernua. |
| | - Caprella lobata. | |

CONTENTS: SEPTEMBER, 1881. No. 6.

- | | | |
|--------------------------|--------------------------------|-------------------------|
| VEGETABLE KINGDOM | | |
| - Bacillaria paradoxa. | | |
| ANIMAL KINGDOM | | |
| - Triloculina trigonula. | - Clytia Johnstoni. | - Rotifer macrurus. |
| - Noctiluca miliaris. | - Medusiform gonozoid. | - Daphnia pulex. |
| - Raphidomona semen. | - Cercaria (Larval Fluke.) | - Larval shrimp. |
| - Epistylis plicatilis. | - Æcistes longipes and pilula. | - Fredericella sultana. |
| - Vaginicola, &c. | - Æcistes Janus. | - Bugula turbinata. |
| | - Conochilus volvox. | |

CONTENTS: MARCH, 1882. No. 7.

- | | | |
|--------------------------------|-------------------------|--------------------------|
| VEGETABLE KINGDOM. | | |
| - Bacteria. | - Asterionella formosa. | - Surirella bifrons. |
| | - Spirulina Jenneri. | - Gyrosigma (various. |
| ANIMAL KINGDOM. | | |
| - Trachelomonas bulla. | - Sertularia pumila. | - Floscularia cornuta. |
| - Telotrochidium crateriforme. | - Aglaophenia pluma. | - Polyphemus pediculus. |
| - Amœba. | - Ophiocoma neglecta. | - Canthocamptus minutus. |
| - Acineta grandis. | - Tubifex rivulorum. | - Doris tuberculata. |
| | - Eolis Landsburgii. | |

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1881.	
Sep. 15.	Limnocoedium Sowerbii
" 23.	Lophopus crystallinus
" 30.	Spirorbis nautiloides
Oct. 7.	Asterionella formosa
" 14.	Polyphemus pediculus
" 21.	Floscularia cornuta
" 28.	Sertularia pumila
Nov. 4.	Vorticella
" 11.	Ophiocoma neglecta
" 18.	Tubifex rivulorum
" 25.	Telotrochidium crateriforme
Dec. 2.	Acineta grandis
" 9.	Pandorina morum
" 16.	Various Marine Diatoms
" 23.	Batrachospermum moniliforme
" 28.	Surirella bifrons
1882.	
Jan. 6.	Ephemera Larva
" 13.	Paramecium aurelia
" 20.	Trachelomonas bulla
" 27.	Aglaophenia pluma
Feb. 3.	Dendrosoma radians
" 18.	Various Freshwater Diatoms
" 17.	Peridinium tabulatum
" 24.	Spawn of Plaise

1882.	
Mar. 3.	Mussel Spat (Anodon)
" 10.	Vaucheria
" 17.	Ecistes crystallinus
" 24.	Eolis Landsburgii
" 31.	Closterium Ehrenbergii
April 6.	Stentor niger
" 14.	Prasiola crispa
" 21.	Melicerta tubicolaria
May 5.	Palmellaceæ
" 12.	Elvers
" 19.	Stylonichia mytilus
" 24.	Cecidium urticæ
June 1.	Lucernaria auricula
" 9.	Perch spawn
" 16.	Ecistes, and other Rotifers
" 23.	Diaptomus castor
" 30.	Limnias annulatus
July 4.	Noctiluca miliaris
" 14.	Pedicellina cernua
" 21.	Cosmarium botrytis
" 28.	Leptodora hyalina
Aug. 4.	Rotifer macrurus
" 11.	Phacus triquetus
" 18.	Mussel Fry (Mytilus)
" 25.	Lacinularia socialis
Sep. 1.	Raphidiophrys pallida

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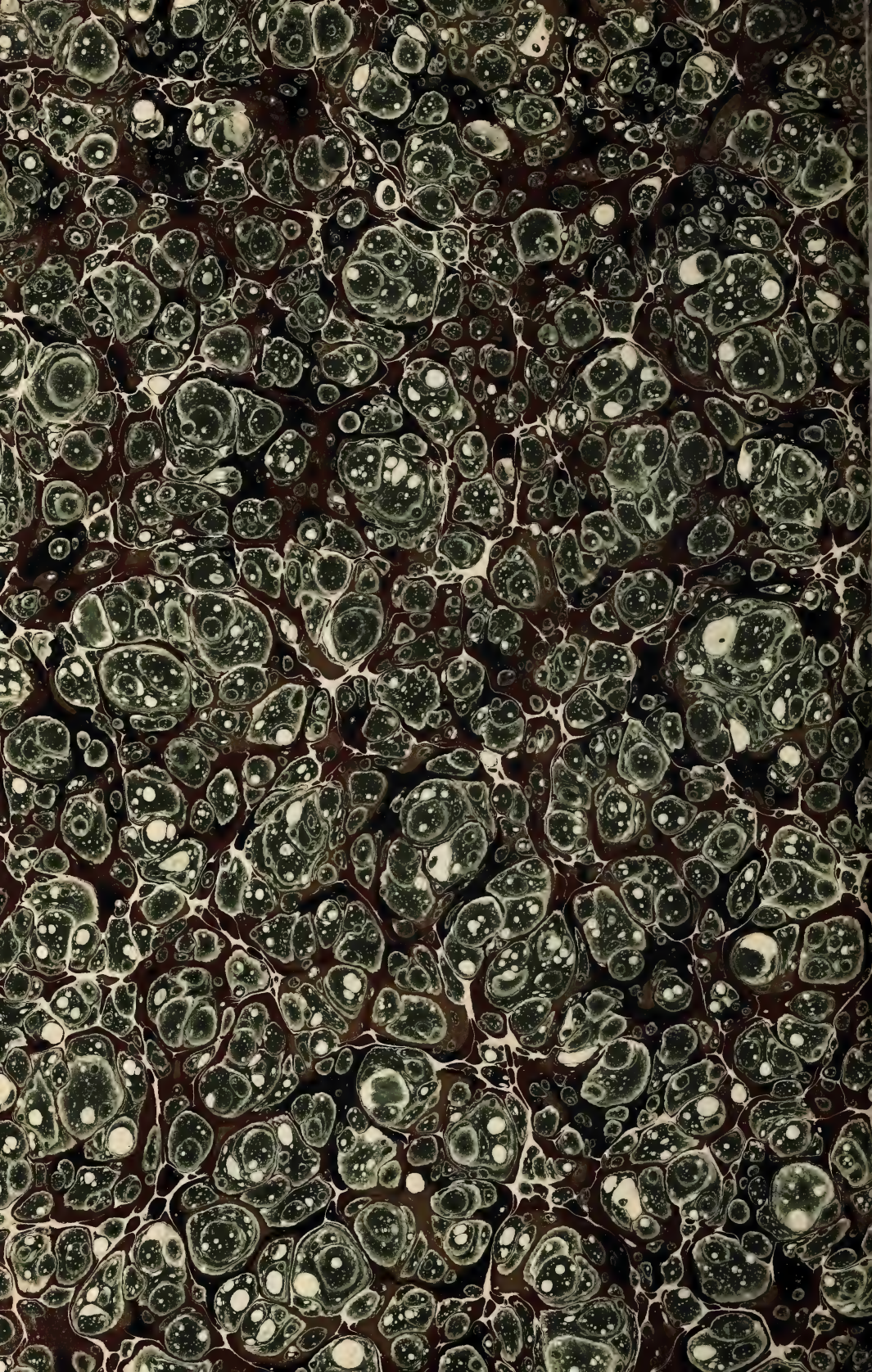
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<i>Leptodora hyalina</i> Male		2..0
— " — — — — " Female		2..0
<i>Pythotrophes Cederströmii</i>		2..6
<i>Polopodium gibberum</i>		2..6
<i>Hydra vulgaris</i>		2..6
<i>Cordylophora lacustris</i>		2..6
<i>Halecium halecinum</i>		2..6
<i>Bugula plumosa</i>		1..6
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<i>Brachionus urceolaris</i>		2..0
<i>Hyalodaphnia Hahlbergensis</i>		2..0
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<i>Anuraea longispina</i> with }		2..0
<i>A. aculeata</i> & <i>A. stipitata</i> }		2..0
<i>Acineta</i>		2..0
<i>Synchaeta mordax</i>		2..0
<i>Paludicella Ehrenbergi</i>		2..6

